CODIS – Continental and Oceanographic Data Information System: A Comprehensive Metadata Inventory and Appraisal of Canada's Arctic and Pacific Ocean datasets, including Software and User Guide.

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CODIS – CONTINENTAL AND OCEANOGRAPHIC DATA INFORMATION SYSTEM: A COMPREHENSIVE METADATA INVENTORY AND APPRAISAL OF CANADA'S ARCTIC AND PACIFIC OCEAN DATASETS, INCLUDING SOFTWARE AND USER GUIDE

by

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ABSTRACT

Fyles, T.M., Smiley, B.D., Robertson, D. and Rowe, R. 2002. CODIS - Continental and Oceanographic Data Information System: A comprehensive metadata inventory and appraisal of Canada's Arctic and Pacific Ocean datasets, including software and user guide. Can. Data Rep. Hydrog. Ocean Sci. 162: vi + 60 p.

The Continental Oceanographic Data Information System (CODIS) is a comprehensive electronic inventory of existing marine and freshwater environmental metadata. CODIS covers physical, chemical and biological disciplines covering 8 arbitrary geographical regions in the Pacific and Arctic Oceans. It also describes the chemical contaminants and benthos data from the Fraser River Basin. CODIS includes tabular details about 1300 different measurement types from nearly 6000 datasets derived from over 4700 references and sources. The data inventoried span the past 190 years up to the mid 1980s, and in some Pacific regions to the mid 1990s. The metadata were gleaned from Arctic and West Coast Data Compilation and Appraisal Program catalogues, most of which is published in the Canadian Data Report of Hydrography and Oceans Sciences No. 5 (Arctic regions) and No. 37 (Pacific regions) series. This report includes the custom software application and user guide ready for installation on a IBM-PC.

RÉSUMÉ

Fyles, T.M., Smiley, B.D., Robertson, D. and Rowe, R. 2002. CODIS - Continental and Oceanographic Data Information System: A comprehensive metadata inventory and appraisal of Canada's Arctic and Pacific Ocean datasets, including software and user guide. Can. Data Rep. Hydrog. Ocean Sci. 162: vi + 60 p.

Le CODIS (système d'informations et de données océanographiques des continents) est un inventaire électronique complet des métadonnées environnementales existantes sur l'eau de mer et l'eau douce. Le CODIS englobe des disciplines physiques, chimiques et biologiques couvrant 8 zones géographiques choisies arbitrairement dans les océans Pacifique et Atlantique. Il décrit également les contaminants chimiques et les données benthiques du bassin du Fraser. Le CODIS renferme des détails tabulaires sur environ 1300 différents types de mesures issus de près de 6000 ensembles de données dérivés de plus de 4700 références et sources. Les données répertoriées couvrent une période de 190 ans allant jusqu'au milieu des années 1980, et pour certaines régions du Pacifique jusqu'au milieu des années 1990. Les métadonnées ont été recueillies à partir de catalogues de compilation et d'évaluation des données pour l'Arctique et la côte Ouest, publiés pour la plupart dans les séries n° 5 (régions arctiques) et n° 37 (régions du Pacifique) du Rapport statistique canadien sur l'hydrographie et les sciences océaniques. Ce rapport comprend une application logicielle personnalisée et le mode d'emploi pour une installation sur un PC/IBM.

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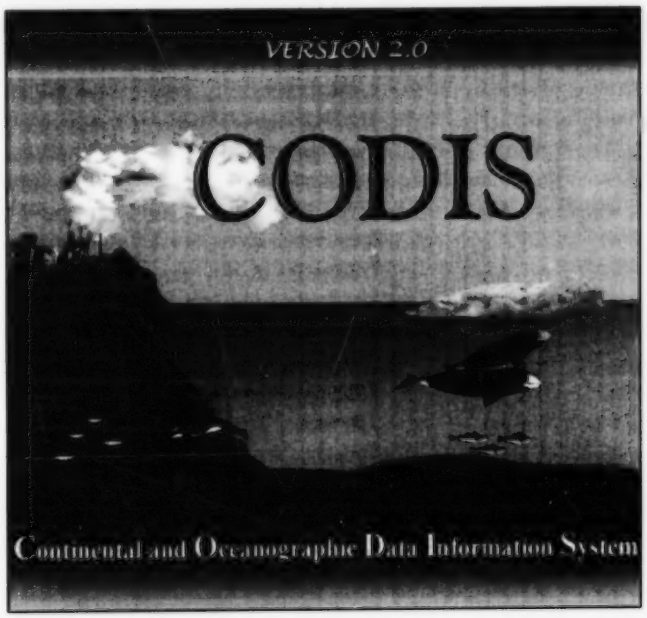


1 Introduction

Welcome to the CODIS User Guide for Version 2.0 !! This guide has four objectives:

- To give some background about CODIS
- To help you get started using CODIS
- To provide examples of CODIS in action
- To show you how CODIS works

1.1 What are metadata?

The Continental Oceanographic Data Information System (CODIS) is a database of environmental metadata. Metadata are "data about data". Publications and other data sources usually contain data, for example, sampling locations, sampling times, measurements on samples and so on. We call this "archival data". Metadata tell what the archival data are about. Metadata answer the newspaper reporter's questions: Who? What? Where? When? Why? How? When it is done correctly, metadata preserve the essential characteristics of the archival data and organize it in a form that can be efficiently stored and quickly queried. Many of the questions you would want to ask of archival data can be just as easily asked of metadata. And the use of metadata opens up new ways to pose questions, and leads to new insights about archival data.

1.2 What is CODIS?

CODIS is a collaborative product, principally of the University of Victoria and the Department of Fisheries and Oceans (DFO). At earlier stages of the project, Environment Canada, the Science Council of British Columbia, and the B.C. Ministry of Environment, Lands, and Parks contributed support and stimulated metadata creation.

Much of the metadata in CODIS are products of DFO's Arctic Data Compilation and Appraisal Program known as ADCAP, and West Coast Data Inventory and Appraisal Program called WESCAP, and derived from published volumes in the Canadian Data Report of Hydrography and Oceans Numbers 5 and 37 (See Section 1.5 for cited references). The published catalogues were originally created from DBase files. The original files from separate catalogues have been combined in a common format for use within CODIS.

CODIS began as a DOS application called CODIS Version 1.0. It was created to handle the Chemistry metadata from the Fraser River Basin in a context that could have been extended to other disciplines. The current version of the program, CODIS 2.0, has been designed to work with Microsoft Access97 and runs on systems using Microsoft Windows95/98/NT. The current version will may or may not run properly under MSAccess2000.

One of the features retained from CODIS 1.0 is the use of QUIKMap for map generation and display. QUIKMap is a very efficient mapping program for DOS, and a seamless integration of searching, reporting, and mapping was achieved in CODIS 1.0. The current 2.0 Version of CODIS uses the latest Windows version of QUIKMap. QUIKMap is provided as a stand-alone program under the license terms explained in the QUIKMap setup program. CODIS passes data back and forth between the two programs with the help of some routines to convert MSAccess data files into versions readable by QUIKMap.

CODIS is comprehensive in scope and detail. It deals with physical, chemical and biological disciplines covering 8 arbitrary geographical regions in the Pacific and Arctic Oceans. It also describes the chemical contaminants and benthos data from the Fraser River Basin. CODIS includes tabular details about 1300 different measurement types from nearly 6000 datasets derived from over 4700 references and sources. The measurement types range from trace organic pollutants to whale vocalizations, from ocean currents to clam enumeration. The earliest measurement recorded is water levels taken in 1819 by the explorer Sir Edward Parry in the Queen Elizabeth Islands. Most of these measurements were assigned a rating from "0" (The data are known to be wrong) though "4" (The data are internally consistent, and sufficiently tied to a standard that inter-comparison is possible), based solely on professional evaluations of the available metadata.

The data inventoried span the past 190 years, up to the mid 1980s for the Arctic regions, and in some cases the mid 1990s for the Pacific regions. The metadata were gleaned from over 4700 references and other sources by 33 investigators who produced 29 published and 4 unpublished catalogues. Sources ranges from field data sheets to published journals, whalers logs to computer archives.

There is really nothing like CODIS anywhere else.

CODIS 2.0 has a number of features common to many types of databases. Metadata can be searched and the results rapidly browsed, printed using standard reports, and also mapped. User's search files can be restored or deleted and the metadata files can be maintained using the software. New metadata catalogues can be created using the software. CODIS 2.0 also has a number of features rarely seen in databases. The documentation is extensive and can be manipulated separately from CODIS. The metadata is accessible to all, and users are encouraged to explore the metadata using the tools of MSAccess to develop customized queries unique to each user's needs. Every aspect of the database is open and accessible to users. We expect you to make CODIS your own. We expect you to break it. We expect you to take it in directions we haven't anticipated.

1.3 Sponsors and funding

From 1979 to 1996, oceanographic data descriptions were compiled and appraised under the scope of the ADCAP and WESCAP programs of the Data Assessment Division (now Marine Environment and Habitat Sciences Division), Science Branch of Fisheries and Oceans Canada, located at the Institute of Ocean Sciences in Sidney, BC. Twenty-two catalogues have been prepared to date; most are published, but several are unpublished manuscripts. No further cataloguing is anticipated because of inadequate funds.

A major objective of these programs has been the early development of an interactive computer database of the environmental information found in the catalogues, initially called ODIS (Oceanographic Data Information System) database. ODIS was a developmental mainframe database in System 2000 and ORACLE, no longer currently available.

Funding for the ADCAP, WESCAP and ODIS programs has come from the Department of Fisheries and Oceans, the Interdepartmental Panel on Energy Research (PERD), and the Northern Oil and Gas Action Plan (NOGAP).

CODIS Version 1.0 was a PC-DOS relative of ODIS, developed as part of the Aquatic Resources Research project: Subcomponent IIIA under the coordination of the UVic Organic Indicators Group. Compilation and appraisal of Continental Chemistry data was done at the University of Victoria. The CODIS software was developed by Axys Environmental Consulting Ltd. under a contract with the University of Victoria. Funding for the Aquatic Resources Research project was provided by the BC Ministry of Environment Lands and Parks and administered by the Science Council of B.C. Additional funding for cataloguing and software development was provided by Environment Canada - Inland Waters Directorate and the Department of Fisheries and Oceans - Green Plan Toxic Chemicals Initiative and Fraser River Basin Study.

A development version of CODIS 2.0 was written under contract with AXYS Environmental Consulting Ltd, and was delivered in March 1994. This version was extensively re-written at the University of Victoria with the participation of UVic Computing Services personnel. Funding for CODIS 2.0 was provided by the Pacific and Central/Arctic Regions of Fisheries and Oceans Canada, and the University of Victoria.

1.4 Protocols and data structure

For CODIS to search diverse disciplines, to restrict searches by geographical area, specific measurement, or specified data quality, and to report the results concisely, the system demands a set of protocols and database structures. To a large degree, CODIS rests on protocols established for the creation of entries, as enunciated in the catalogues published under the ADCAP/WESCAP program. The central premise is

that data collected by various workers can be usefully organized by both discipline and geographical region. CODIS assumes that the important feature of the original data is what they are ABOUT: where was the measurement done? when was it done? what was measured? how was the measurement done? and finally was the measurement reliable? CODIS places little or no emphasis on what the actual results of the measurement were, although some disciplines do record average values for a set of measurements and their data products.

The unit of organization of highest importance to CODIS is the "dataset". A dataset is derived from a source or reference, whether published or not, as a unique body of measurements that are united by certain characteristics. The measurements in a dataset were taken with the intent that they be internally consistent, probably by a single individual, team or organization, which sampled a particular area usually for a well-defined reason. The quality of every dataset is rated. This doesn't mean that all the entries of a dataset are about the same type of measurement. Some datasets combine measurements of a number of different individual constituents by a number of different methods. Even so, each dataset is unique and the quality of the data in each dataset can be rated.

The information in CODIS is derived by a formal process of data compilation and cataloguing. The sequence involves locating the data sources for a defined geographical region in a defined discipline, determining unique datasets from each data source, documenting the measurement process, assessing data quality for each dataset, and finally updating the CODIS data files.

The data in CODIS is organized geographically in three major areas: Arctic, B.C. West Coast and B.C. Fraser Basin and within the major areas by defined regions e.g. "Beaufort Sea" in the Arctic or "Lower Fraser" in the Fraser Basin. The scientific disciplines identified in CODIS are: Ocean Physics, Ocean Chemistry, Continental Chemistry, Marine Plankton, Marine Benthos, Marine Fish and Marine Mammals. Ocean Physics covers data on ocean currents, salinity, temperature, water levels and waves. The Chemistry disciplines cover chemical constituents (individual compounds, classes of compounds) in various environmental media such as sediments, water, and biota. The two Chemistry disciplines are distinguished only by an extended data quality-rating scheme in the Continental Chemistry. The biological disciplines cover measurements of taxa or species abundance, distribution, growth, morphometrics, food, behaviours and so on.

There are also differences between the disciplines in the way that hierarchical relationships are established; these differences are encountered by the user when running CODIS. Differences also exist between disciplines in the data quality rating protocols.

Despite inter-disciplinary differences forced on CODIS by the subject matter, the approach to data is generally constant across the disciplines. As already mentioned, CODIS contains "data" about data, which can be explored without reference to the

original measurement values. In some cases this level of exploration may be completely adequate to answer the question being posed. In other cases, CODIS may be used to identify references to original data critical to solving the problem.

CODIS strives to maintain the standards and contents originally established in the published catalogues of the ADCAP/WESCAP program. Most of that information is now accessible in CODIS. At the same time, all new information supplied to CODIS is compatible with the previous data formats and protocols. The data files and their fixed relationships are outlined in the Data Dictionary, available under the *Learn About CODIS* button on the Main Menu. All CODIS data, new or old, respects these fixed relationships. Although invisible to users, CODIS structure is implied by the available search terms and report formats.

CODIS is a collaborative product intended to serve a diverse group of users. Its developers believe that a wide distribution of CODIS is desirable and hope that enthusiasm for the data directory and data quality rating approach to environmental information will foster further developments and improvements of CODIS.

Once again a reminder -- CODIS 2.0 is fully functional. This allows not only searching, mapping and reporting of the data files, but also data modification and entry. So the reliability of the data is only guaranteed for a database directly created by the "install" version.

We encourage you to use the program and the capabilities of MSAccess to customize and create your own versions. For example, there are more details in the data files of most disciplines than presently reported as output by this CODIS version. Feel free to look inside if you are familiar with MSAccess software.

1.5 Inventory status and source references

The following information is also presented within CODIS by clicking on *Learn About CODIS* in the Main Menu and followed by *Inventory Status*.

Catalogued Inventories Included in CODIS Version 2.0
Status (as of August 1997)

Geographical Region	Discipline	Date Range	Number of Data Sets	Catalogue Reference * denotes unpublished catalogues
Arctic Regions:				
Canadian Beaufort Sea - Amundsen Gulf	Ocean Physics	1914 thru 1986	259	Comford et al. 1982 Birch et al. 1987
	Ocean Chemistry	1950 thru 1987	155	Thomas et al. 1982 Thomas et al. 1990
	Marine Plankton	1914 thru 1985	82	Woods and Smiley 1987
	Marine Zoobenthos	1914 thru 1986	109	Wainwright et al. 1987
	Marine Fishes	1896 thru 1985	89	Ratynski et al. 1988
	Pinnipeds (Seals)	1826 thru 1985	172	Harwood et al. 1986
	Cetaceans (Whales)	1848 thru 1983	143	Norton et al. 1987
Queen Elizabeth Islands	Ocean Physics	1819 thru 1988	137	Fissel et al. 1983 Birch et al. 1990
	Ocean Chemistry	1952 thru 1985	32	Thomas et al. 1986
	Marine Fishes	1901 thru 1984	87	Ratynski and de March 1988
Northwest Passage	Ocean Physics	1820 thru 1986	165	Birch et al. 1983 Birch et al. 1987
	Ocean Chemistry	1928 thru 1990	84	Thomas et al. 1983 Thomas et al. 1991
	Marine Fishes	1819 thru 1985	87	Ratynski and de March 1988
	Pinnipeds (Seals)	1834 thru 1985	159	Harwood et al. 1988
	Cetaceans (Whales)	1820 thru 1984	143	Norton et al. 1987
Baffin Bay	Ocean Physics	1900 thru 1981	162	Birch et al. 1983
Canada Basin - Arctic Ocean	Ocean Physics	1883 thru 1983	340	Birch et al. 1984
	Ocean Chemistry	1926 thru 1983	134	Thomas et al. 1986
Pacific/West Coast Regions:				
Dixon Entrance, Hecate Strait, Queen Charlotte Sound and Adjoining B.C. Coastal Waters	Ocean Physics	1903 thru 1984	357	Birch et al. 1985
	Ocean Chemistry	1937 thru 1984	138	Thomas et al. 1986
	Marine Mammals	1862 thru 1991	112	Nichol et al. 1993
B.C. Offshore Waters to 200 Miles	Ocean Physics	1903 thru 1984	509	Birch et al. 1986
	Ocean Chemistry	1932 thru 1982	261	Thomas and Macdonald 1986 *
	Marine Mammals	1879 thru 1996	269	Nichol et al. 1997 *
Strait of Georgia and Adjoining Waters	Ocean Chemistry	1926 thru 1983	784	Thomas and Macdonald 1986 *
	Marine Mammals	1879 thru 1996	269	Nichol et al. 1997 *
Fraser River Basin, including: the Estuary, Lower Basin, Middle Basin, Upper Basin, Thompson Sub-Basin, Nechako Sub-Basin	Continental Chemistry	1965 thru 1992	578	Fyles et al. 1993
	Continental Benthos	1930 thru 1991	168	Johansen and Reis 1994

Data set information for Arctic regions is largely published in the Canadian Data Report of Hydrography and Ocean Sciences No.5 series, as volumes of the Arctic Data Compilation and Appraisal Program (ADCAP).

The following volumes are part of this series.

Cornford, A.B., D.D. Lemon, D.B. Fissel, H. Melling, B.D. Smiley, R.H. Herlinveaux and R.W. Macdonald. 1982. Beafort Sea: Physical Oceanography - Temperature, Salinity, Currents and Water Levels. Vol. 1, 279p.

Thomas, D.J., R.W. Macdonald and A.B. Cornford. 1982. Beaufort Sea: Chemical Oceanography. Vol. 2, 243p.

Birch, J.R., D.B. Fissel, D.D. Lemon, A.B. Cornford, R.A. Lake, B.D. Smiley, R.W. Macdonald and R.H. Herlinveaux. 1983. Northwest Passage: Physical Oceanography - Temperature, Salinity, Currents and Water Levels. Vol. 3, 262p.

Thomas, D.J., R.W. Macdonald, A.G. Francis, V. Wood and A.B. Cornford. 1983. Northwest Passage: Chemical Oceanography. Vol.4, 200p.

Birch, J.R., D.B. Fissel, D.D. Lemon, A.B. Cornford, R.H. Herlinveaux, R.A. Lake and B.D. Smiley. 1983. Baffin Bay: Physical Oceanography - Temperature, Salinity, Current and Water Levels. Vol. 5, 372p.

Fissel,D.B., L. Cuypers, D.D. Lemon, J.R. Birch, A.B. Cornford, R.A. Lake, B.D. Smiley, R.W. Macdonald and R.H.Herlinveaux. 1983. Queen Elizabeth Islands: Physical Oceanography - Temperature, Salinity, Currents and Water Levels. Vol. 6, 214p.

Birch, J.R., D.B. Fissel, A.B. Cornford and H. Melling. 1984. Canada Basin - Arctic Ocean: Physical Oceanography - Temperature, Salinity, Current and Water Levels. Vol. 7, 624p.

Harwood, L.A., L.A. Turney, L. de March, B.D. Smiley and P. Norton. 1986. Beaufort Sea: Biological Oceanography - Seals, 1826-1985.Vol. 8 (Part 1, 352p., Part 2, 301p.).

Woods, S. and B.D. Smiley. 1987. Beaufort Sea: Biological Oceanography - Bacteria, Plankton, Epontic Community, 1914 to 1985. Vol. 9, 394p.

Norton, P., B.D. Smiley and L. de March. 1987. Beaufort Sea: Biological Oceanography - Whales, 1848 to 1983. Vol. 10, 407p.

Wainwright, P.F., B.D. Smiley and A. Blyth. 1987. Beaufort Sea: Biological Oceanography - Marine Zoobenthos, 1914 to 1986. Vol. 11, 367p.

Birch, J.R., D.D. Lemon, D.B. Fissel and H. Melling. 1987. Beaufort Sea and Amundsen Gulf: Physical Oceanography - Temperature, Salinity, Currents, Water Levels and Waves. Revised and Updated to Include 1914 through 1986. Vol. 12, 459p.

Norton, P., L. de March and B.D. Smiley. 1987. Northwest Passage: Biological Oceanography - Whales, 1820 to 1984. Vol. 13 (Part 1, 244p., Part 2, 487p.).

Birch, J.R., D.B. Fissel, D.D. Lemon and R.A. Lake. 1987. Northwest Passage: Physical Oceanography - Temperature, Salinity, Currents, Water Levels and Waves. Revised and Updated to Include 1820 through 1986. Vol. 14, 300p.

Ratynski, R.A., L. de March and B.D. Smiley. 1988. Beaufort Sea: Biological Oceanography - Fish, 1896 through 1985. Vol. 15 (Part 1, 293p., Part 2, 271p.).

Thomas, D.J., M. Yunker, P. Wainwright and R.W. Macdonald. 1986. Queen Elizabeth Islands: Chemical Oceanography, 1952 through 1985. Vol. 16, 125p.

Ratynski, R.A. and L. de March. 1988. Northwest Passage and Queen Elizabeth Islands: Biological Oceanography - Fish, 1819 through 1985. Vol. 17, 416p.

Thomas, D.J., R.W. Macdonald and M. Robinson. 1986. Canada Basin: Chemical Oceanography, 1926 through 1983. Vol. 18, 109p.

Harwood, L.A., P. Norton, L. de March and B.D. Smiley. 1988. Northwest Passage: Biological Oceanography - Pinnipeds, 1834 to 1985. Vol. 19, 450p.

Thomas, D.J., F. Noone, A. Blyth and B.D. Smiley. 1990. Beaufort Sea: Chemical Oceanography - Hydrocarbons, Metals, Pigments, Nutrients, Oxygen and Others. Revised and Updated to Include 1950 through 1987. Vol. 20 (Part 1, 347p., Part 2, 171p.).

Birch, J.R., D.B. Fissel and B.D. Smiley. 1990. Queen Elizabeth Islands: Physical Oceanography - Temperature, Salinity, Currents and Water Levels. Revised and Updated to Include 1819 through 1988. Vol. 21, 246p.

Thomas, D.J., F. Noone, A. Blyth and B.D. Smiley. 1991. Northwest Passage: Chemical Oceanography - Hydrocarbons, Metals, Pigments, Nutrients, Oxygen and Others, 1979 through 1990. Supplement to Volume 4 - Update to 1990. Vol. 22, 86p.

Data set information for West Coast regions is largely published in the Canadian Data Report of Hydrography and Ocean Sciences No. 37 series, as volumes of the West Coast Data Inventory and Appraisal Programme (WESCAP). *Unpublished volumes in this series are denoted with *. The Fraser River Basin references are not part of this series but are listed here as the last two references.*

Birch, J.R., E.C. Luscombe, D.B. Fissel and L.F. Giovando. 1985. Dixon Entrance, Hecate Strait, Queen Charlotte Sound and Adjoining B.C. Coastal Waters: Physical Oceanography - Temperature, Salinity, Currents, Water Levels and Waves, 1903 through 1984. Vol. 1 (Part 1, 302p., Part 2, 265p.).

Birch, J.R., L.F. Giovando and D.B. Fissel. 1986. Waters West of Vancouver Island and the Queen Charlotte Islands out to the 200-Mile Fishery Limit: Physical Oceanography - Temperature, Salinity, Currents, Water Levels and Waves, 1905 through 1984. Vol. 2 (Part 1, 502p., Part 2, 324p.).

Thomas, D.J., R.W. Macdonald and A.G. Francis. 1986. Dixon Entrance, Hecate Strait, Queen Charlotte Sound and Adjoining B.C. Coastal Waters: Chemical Oceanography - 1937 through 1984. Vol. 3 (Part 1, 278p., Part 2, 248p.).

* Thomas, D.J. and R.W. Macdonald. 1986. The Strait of Georgia and Adjoining British Columbia Inlets and Waters: Chemical Oceanography, 1926 through 1983. Unpublished report to the Department of Fisheries and Oceans, Sidney, British Columbia, 451p.

* Thomas, D.J. and R.W. Macdonald. 1986. Waters West of Vancouver Island and the Queen Charlotte Islands out to the 200-Mile Fishery Limit: Chemical Oceanography. Unpublished report to the Department of Fisheries and Oceans, Sidney, British Columbia.

Nichol, L.M., P.F. Wainwright, P.F. Olesiuk and B.D. Smiley. 1993. Dixon Entrance, Hecate Strait, Queen Charlotte Sound and Adjoining B.C. Coastal Waters: Biological Oceanography - Marine Mammals, 1862 through 1991. Vol. 4, 321p.

* Nichol, L.M., J.A. Booth and B.D. Smiley. 1997. The Strait of Georgia and Adjoining B.C. Inlets, Waters West of Vancouver Island and the Queen Charlotte Islands out to the 200-Mile Exclusive Economic Zone: Biological Oceanography - Marine Mammals, 1979 through 1996. Unpublished report to the Department of Fisheries and Oceans, Sidney, British Columbia, 109p.

Fyles, T.M., B. King and P.R. West. 1993. Continental and Oceanographic Data Information System, CODIS version 1.0. Protocols, Software, Compilation and Appraisal of Meta-Data of Organic Contaminants in the Fraser River Basin. Prepared for the Conservation and Protection Service, Environment Canada. Published as DOE FRAP 1993-24, 260p.

Johansen, J.A. and K.E.M. Reis. 1994. Fraser River Basin Benthic Invertebrate Catalogue - Continental and Oceanographic Data Information System (CODIS). Prepared for the Conservation and Protection Service, Environment Canada. Published as DOE FRAP 1994-17, 104p.

2 Getting started

The CODIS database itself is one very large file, but there are a number of additional text and mapping directories and files which need to be in place. The installation CD sets up the directory structure that CODIS expects, and copies the required files to your hard drive

We assume that MSAccess 97 is installed on a Windows 95/98/NT platform on a personal computer (PC). It may or may not work reliably or predictably if MSAccess 2000 is installed. No network, client-server architecture or other support is necessary. Some of the text files called by CODIS 2.0 will look for MSWord 97 or higher. If you do not have MSWord, the software will complain a bit. Other word-processing packages will allow you to get at the text information files directly, so you will not be completely locked out.

The current version of CODIS uses QUIKMap 4.0 for mapping. You can run the CODIS 2.0 version without QUIKMap, but you will not be able to use the mapping functions. CODIS generates DBaseIV format files for mapping, so other mapping programs might be able to use the same files.

The MSAccess file called CODIS2.MDB occupies approx. 60 Mbytes of disk space (minimum) and will expand to twice that size as you work with it. Ideally, you need minimum of 120-150 MBytes of free space to install CODIS and allow it to roam. The QUIKMap program is installed in its own directory and is fully functional within the constraints of the QUIKMap license detailed in the install program. It requires at least 50MB of free space on the C Drive for temporary files during the install but once installed to the directory of your choice should only require about 12MB on that drive.

2.1 Install CODIS from the CD-ROM

To install the program, insert the CD in your CD-ROM drive. If you have "autorun" enabled, the install program will start automatically. If the program does not start automatically (wait for a few moments to make sure) you can manually start the install program by clicking on "START" and then "RUN". Type the drive letter of your CD drive followed by a colon and a backslash, and then "setup.exe" (e.g. E:\setup.exe). Click on "OK".

During the installation the program will ask you questions and offer you choices on where to locate the CODIS 2.0 files. If possible, accept the default location for the files. If this is not possible try to place the files on a drive nearest your root drive (usually the "C" drive). Doing this will speed the startup of the CODIS 2.0 database in normal use.

The complete CODIS install is accomplished in two parts. CODIS should be installed first followed by QuikMap. They are placed in separate directories and folders.

For licensing agreement purposes, you will be asked to enter two long, awkward numbers:

QUIKMap Serial Number: 106382635
QUIKMap Code Number: 431F 7351D 50 BFDAB

No further "tweaking" of the registry and autoexec.bat files is needed, the install program takes care of all of that for you. Once the installation is complete you will be asked to re-start your computer. You must do this before you run CODIS 2.0 because the program changes made by the install program will not take effect until after the computer has re-booted. After installation, the CD will be your backup and resource copy while all CODIS 2.0 functions will run from the PC hard drive.

2.2 Tips on backup and COMPACTing

We recommend keeping a copy of the CODIS2.MDB file alongside the working file. One approach is to use pkzip to make a compressed version of CODIS2.MDB on the harddrive at installation time. In the CODIS2 directory, type something like "c:\pk\pkzip codis.zip codis2.mdb" to accomplish this. In this expression, the target file is codis.zip and the source to compress is codisii.mdb. This codis2 file could be retrieved easily using pkunzip if the original were lost. Similarly, personalized copies of the CODIS.MDB file might be saved.

The active CODIS MSAccess file needs to be maintained over days and weeks of use of the application. Refer to the following directions and also see the notes in MSAccess regarding COMPACTing a database.

1. Close database
2. Open MSAccess
3. Click on *File, Compact Database* or *Tools, Database Utilities, Compact Database* in MSAccess 97.
4. Find where you put CODIS2.MDB, it should be in the CODIS2 Library. Highlight CODIS2.MDB and click *OK*.
5. Compact back into CODIS2.MDB. Since it already exists you will want to replace it.
6. Congratulations, you have just COMPACTed a database!

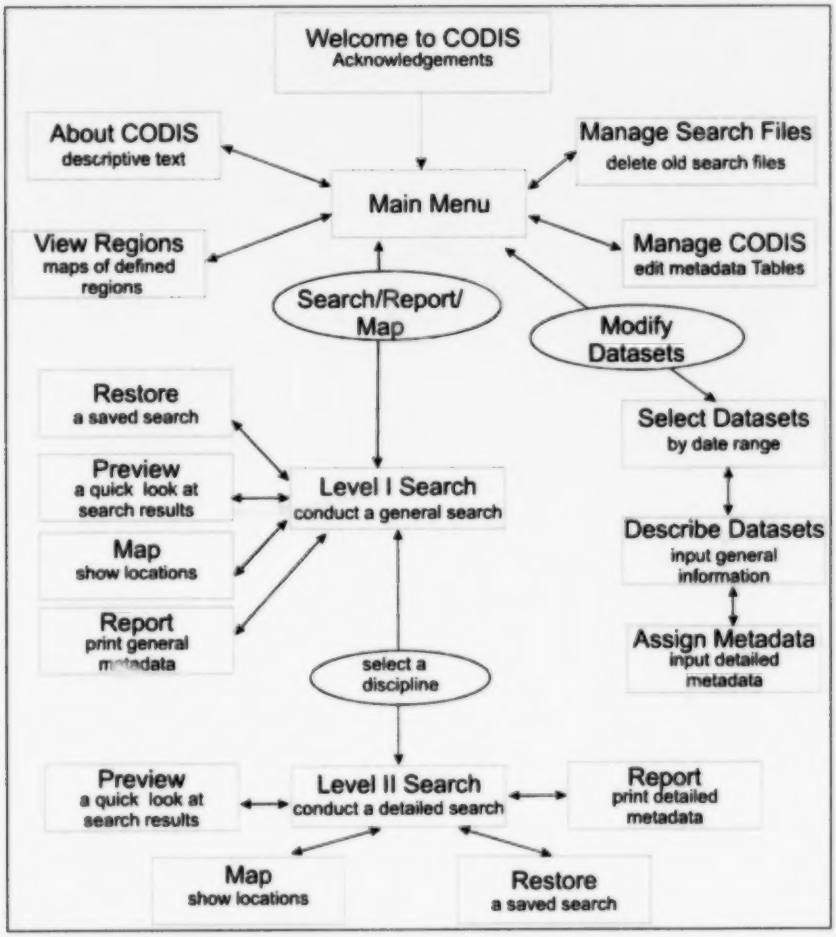
After perhaps ten hours of query and report creation (and deletion!) COMPACTing is advisable. This is how we envision normal CODIS use. CODIS is disk aggressive and will chew away at the free space. Be vigorous in deleting unused "Search" files, and COMPACTing regularly.

2.3 Trouble shooting

A great deal of effort has been made to ensure that the CODIS/QUIKMap suite will run smoothly on most computer systems covered by the minimum specs. CODIS is a large database and will benefit from a fast processor and hard disk. Please note that CODIS 2.0 will NOT run under Microsoft Windows ACCESS2000™ and that installation of ACCESS97 and ACCESS2000 on the same system is not normally possible. For troubleshooting and help with QUIKMap please refer to the help files and options listed within the QUIKMap program. In the future, there are plans for a CODIS webpage with a "Frequently Asked Questions" that will also provide assistance.

3 Understanding CODIS forms

What you see when CODIS runs are called "forms" by the Microsoft gurus. CODIS forms have uniform appearance and function. These forms have similar text and button style, background color and presentation. As you move around in CODIS, you are just shifting your attention from one form to another. For example, when the Windows application icon for CODIS is "clicked" with the mouse, the "*Welcome form*" appears in full screen view. This opening form is acknowledged by pressing the *OK* button (i.e., another mouse "click"). The CODIS Main Menu will replace the "Welcome form" on the full screen view. All of the CODIS forms can be visited (usually indirectly) from the main menu. CODIS operations proceed using these forms for selection of tasks. CODIS forms are linked so that progression through the forms is made in a logical sequence. These form connections can be mapped as shown on the next page.

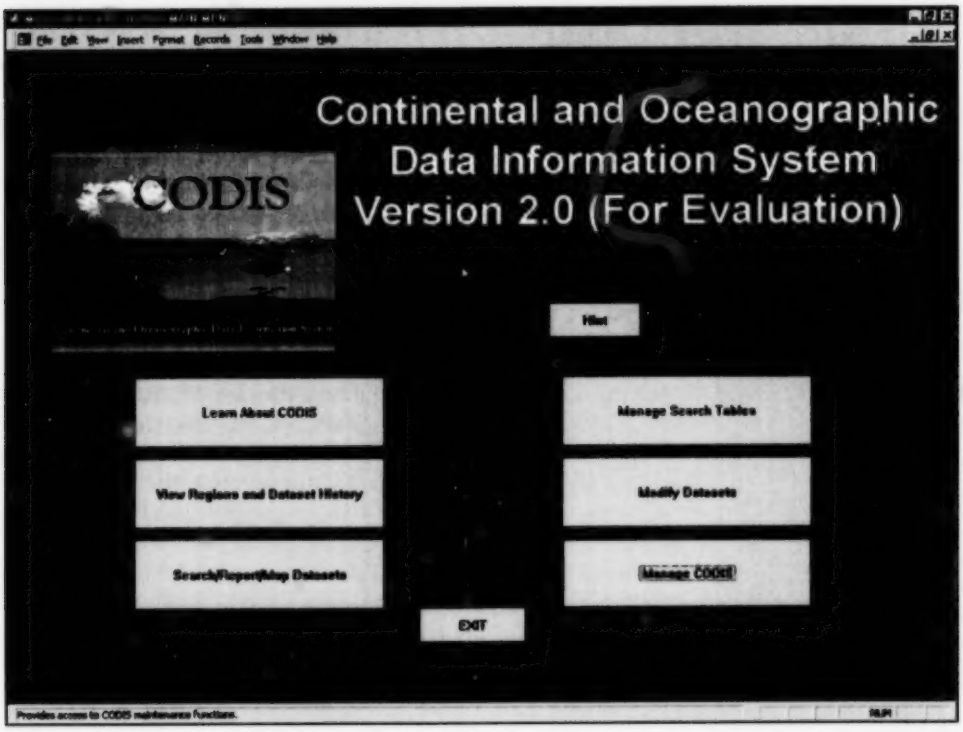


Relationships between CODIS forms

In the above Figure, the rectangles describe the forms. The large text is the title of the form, and the smaller text tells a bit about the form function. The ellipses between forms describe the process goals that a user would wish to achieve and the arrows suggest the direction the typical user will want to move in the program. Thus, at each form the user is directed to choose one of several actions. Beginning at the *Main Menu* form, pathways proceed into the tree for various tasks. Following the completion of tasks, these steps are retraced. Finally the viewpoint returns to the *Main Menu* form. The *Exit* button on the *Main Menu* will close the MSAccess session.

3.1 Get familiar with CODIS menus

MSAccess is a Windows application so CODIS forms are always presented in Microsoft Windows. There are both costs and benefits to this. Other applications in other windows can be open at the same time. (In Windows95/98 or WindowsNT these tasks can run concurrently.) The MSAccess windows can be "minimized" or sized otherwise, if desired. CODIS can be moved to the background while other PC programs are used. In short, there are many windows details that can be explored around and within CODIS. A further example in CODIS is the scroll bars that appear on many CODIS forms. An example of a CODIS form is shown below.



A view of the Main Menu as an example of a CODIS form

Each CODIS form window has a title caption. The caption is the unique name of the form in the database and usually tells you something about the form. The second line is a menu bar. The default MSAccess menu bar is always in view in this version of CODIS. This implies all tables, forms, queries, reports and modules are available for view or edit, provided the *Window, Unhide* function has been used in the session. Your menu bar may look more complicated than ours may. Depending upon the version of MSAccess, we used either the *View, Toolbar* or *Tools, Options* function to turn off the extra stuff.

There is "Status bar text" in the bottom left edge of CODIS forms. This text indicates the purpose of the sensitized areas currently under the mouse. For example, a mouse movement onto a button will result in a short message at the bottom of the form window, describing the purpose of the button.

The form title is located on the CODIS background. This title is located in the form header and is supposed to tell you what the form will do for you. There is also a *Hint* button in some CODIS headers. These hints are more detailed explanation on how to use of current form. The text of the hint is displayed when the *Hint* button is pressed. CODIS continues when this Message Box is acknowledged. (Click the *OK* button inside that box). The form footer (parallel to the form header) is located at the bottom of the form. The footer usually contains *OK*, *CANCEL* or *EXIT* buttons. These are CODIS controls for movement to other forms.

There are usually several buttons on the form body, together with selection boxes, and other text instructions. The buttons, the tools of action in CODIS, are context sensitive. Movement of the mouse onto a button is reflected on the form's status bar. Clicking these buttons will cause actions - actions in the database, actions on a form, queries of the database, etc.

A *CANCEL* function is usually located in form footers. *CANCEL* will close the current form. The form one step up in the forms tree (towards the Main Menu) will be presented. This previous form is viewed exactly as it was last seen (including data). Note that pressing the *CANCEL* button will NOT stop execution of a query or MSAccess code. The *Ctrl, Break* keyboard combination will make execution stop. This abrupt halt is "dirty" and some Windows messages will have to be acknowledged.

The *OK* button will cause CODIS to complete the current entries in the viewed form. The view in CODIS will move to another form.

The CODIS user interface (i.e., actions on the forms in CODIS) is event-driven. Events include mouse movement, button clicks, form changes, or making a selection from a list box. When any of these events occurs, software attached to these form "hot spots" will start up. Sometimes this code execution takes a while, during which time the hourglass display will demonstrate the "busy" condition for the database.

The forms are the presentation level of the database, in other words, they create the view of reports, data, datasets, tables, etc. that make up CODIS. Alternatively, all of the CODIS features can be manipulated without the forms. The first step in any of these manipulations is to click on *Window, Unhide* on the menu bar. The database can then be explored. Much of MSAccess is intuitive and some guidelines for working directly with the database are given in another section of this User Guide.

There is always an alternative to using the mouse for movement in MSWindows. The TAB key will move the cursor through the various "live" spots on a form. If one is typing text, the tab key can be advantageous.

4 Demonstrating CODIS functions

The purpose of this section is to walk you through a simple CODIS search. You will push some buttons, get some results, and get a look at how things work. We may answer some questions along the way.

For this to work, we will need a question. For example, what does CODIS know about chemical contaminants around Kamloops, B.C., in the late 80's? Not a very well formulated question, but it will do for this.

1. We start at the Main Menu. Move the mouse over the buttons and watch the *Status* bar on the lower left part of the screen. This shows a standard feature of CODIS, you can always find out what a button does by moving the mouse over it.

2. Push the *Hint* button in the upper right corner. This gives you some ideas about what to do with this form. Watch for other *Hint* buttons on other screens.

3. So where is Kamloops, B.C. in the CODIS world? To find out you need to press the *View Regions and Dataset History* button. A selection of region names is displayed. Press the *Thompson Sub-Basin* button to see a picture of the boundaries of this region. Kamloops is in this Region. Click on *CANCEL* to return to the Main Menu.

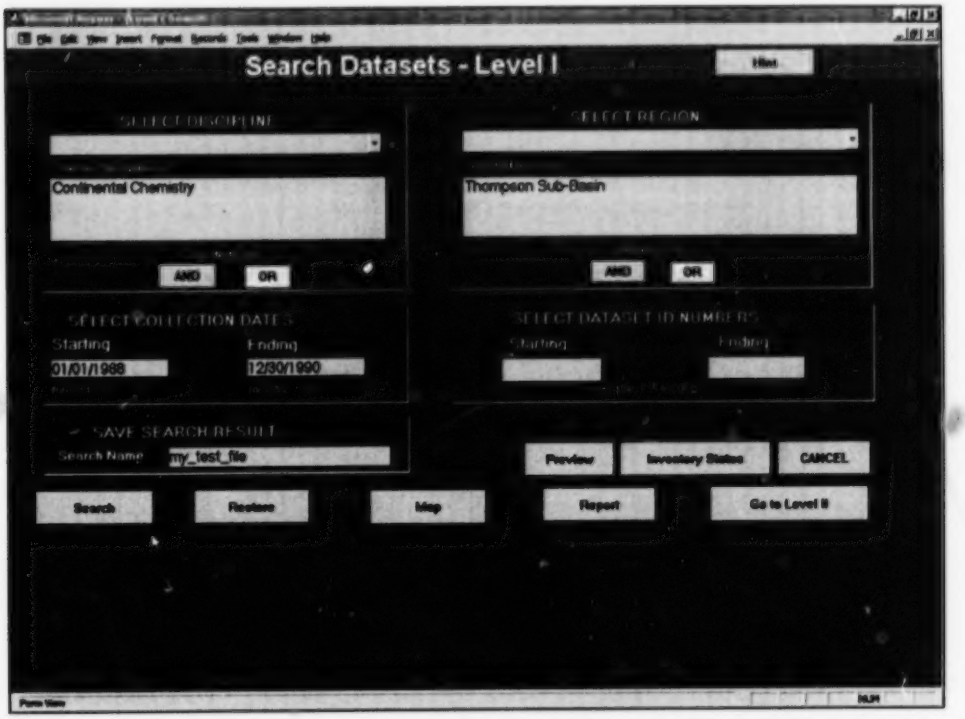
4. So we are ready to search. Click the *Search/Report/Map Datasets* button. This takes you to the Level 1 search screen. Hint: look for the *Hint* button and click it.

5. Click the scroll bar below the *Select Discipline* title. A list is presented. Click *Continental Chemistry* to select.

6. Do the same process to select the Thompson Sub-Basin Region under the *Select Region* title.

7. Type in the date range for the search under the *Select Collection Dates* title. Late 80's could mean January 1, 1988 to December 30, 1990.

8. Type in a Search Name under the *Save Search Result* title. This can be a long string of letters and numbers, but can have no spaces. "my_test_file" is what we typed. The result at this point will look something like the screen on the next page.

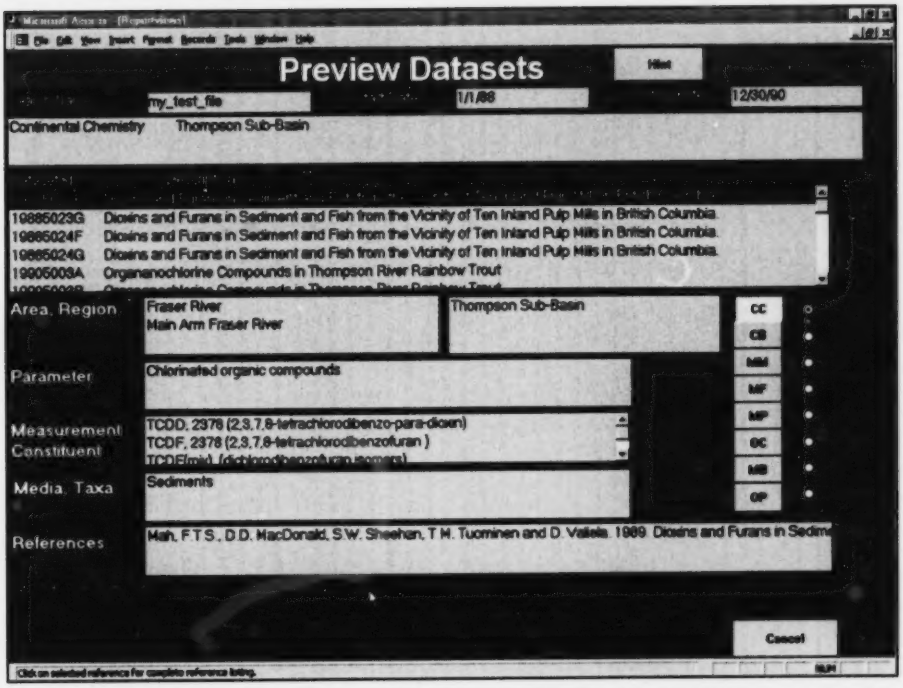


The Level 1 Search Datasets screen set to start a search

9. All set? Now click the *Search* button. The hourglass shows things are happening and a dialogue box appears with the result that 16 Datasets fulfilled the search criteria specified. Click *OK*.

10. Let's quickly browse the results. Click the *Preview* button to move to the *Preview Datasets* form. When you first get here the boxes at the bottom are blank. Hint: where is the *Hint* button? The hint instructs you to click on a Dataset ID to select it for display.

11. If you click on 19885023F, the display will look something like the screen on the next page. The screen includes a number of CODIS features. The boxes are the "global" metadata for the Dataset ID selected. This is large-scale information about the dataset, such as, where was the area sampled, what Parameters and Measurements were involved, what is the bibliographic citation? The column of buttons to the lower right will report the existence of concurrent information in other disciplines if it is available. Browse around. Note that you can click the bibliographic citation to pull up the full details. To close the expanded citation box, click *OK*.



Screen showing Preview Datasets form with Dataset 198850023F selected.

11. Let us assume we like these results well enough to print them. Click *CANCEL* to return to the Level 1 search screen, and click *Report*. You get to a screen with a choice of eight disciplines. Why give you a choice if all we want is Continental Chemistry in this case? Since CODIS is inherently multi-disciplinary, a search could involve several disciplines. Reports have to be generated on a discipline-by-discipline basis, so we need to allow a user to select what discipline to report. If you click a discipline where the search has given no metadata you just get an empty report.

    In this case you click *Continental Chemistry*. There is a pause while the Report Writer pulls all the bits together and formats the page. You get a print preview similar to the example on the next page. The header gives a short summary of the search terms you selected, the name of the search file, and the time and date the report was generated.

CODIS 2.0 Continental and Oceanographic Data Information System

Dataset Summary Report for Continental Chemistry

Search Terms:

Discipline(s): Continental Chemistry

Region(s): Thompson Sub-Basin

Collection Period: Start Date: Friday, January 01, 1988 End Date: Sunday, December 30, 1990

Search File Name: my_test_file

Report generated: 8/30/97 2:03:20

DS_ID: 19885023F Unique_ID: BLAIR1992101544688.97

Collection Period: Start Date: 3/21/88 Stop Date: 9/27/88

Region(s): Thompson Sub-Basin

Area(s): Fraser River, Main Arm Fraser River

Parameter(s): Chlorinated organic compounds

Constituent(s): HeptaDD (mix), HeptaDF (mix), HexaDD (mix), HexaDF (mix), OctaDD (octachlorodibenzo-para-dioxin), OctaDF (octachlorodibenzofuran), PentaDD (mix), PentaDF (mix), TCDD (mix), TCDD, 2378 (2,3,7,8-tetrachlorodibenzo-para-dioxin), TCDF(mix) (dichlorodibenzofuran isomers), TCDF, 2378 (2,3,7,8-tetrachlorodibenzofuran)

Media: Sediments

Reference(s): Mah, F.T.S., D.D. MacDonald, S.W. Sheehan, T.M. Tuominen and D. Valiela. 1989. Dioxins and Furans in Sediment and Fish from the Vicinity of Ten Inland Pulp Mills in British Columbia. Inland Waters, Environment Canada, Pacific and Yukon Region. Vancouver, B.C. May 1989. 77p.

Secondary References:

Agency:

Platform:

Description: Dioxins and Furans in Sediment and Fish from the Vicinity of Ten Inland Pulp Mills in British Columbia.

Cataloguer's Comment: P.R # 68 F

Catalogue Status: Unknown

Concurrent Information in CODIS:

Discipline:Parameter(s):

12. The body of the report gives the same information as you saw on the preview form: the Dataset ID (DS_ID), the Collection Period of the dataset, the CODIS Region(s) assigned, the named Area(s), the Parameter(s), Constituent(s), Media, Reference(s), and so on.

13. A couple of points to bear in mind here: In this example, the long list of constituents contains abbreviations. Usually these are fairly obvious but maybe only to chemists. The full names of constituents and their Chemical Abstract Service (CAS) Registry numbers are associated with these abbreviations in a CODIS table, so you could work back to a precise name. A similar situation occurs on reports involving species; a short name or common name is reported, but the full taxonomy is behind the scenes.

14. Some of the fields are blank. This usually means that the cataloguer felt the data source did not contain that piece of information. Some items are cryptic: Unique ID, Cataloguer's Comment, and Catalogue Status. These are essential for cataloguers to link the CODIS world to the real world of pieces of paper. They are there to help CODIS grow. In this instance the Concurrent Information section is empty. If there were information from other CODIS disciplines with the same Dataset ID, then a list of Parameters would be generated in this section.

15. And now you want a map. Use *File, Close* on the *Print Preview*, and *CANCEL* on the *Search Discipline - Level 1* form to get back to the Level 1 search form. Click on *Map*. You get to another discipline selection form. The Map function can plot more than one discipline, so you need to click the one(s) you want. When they are selected, they shift to the right hand column. Clicking on the right hand column removes them from the selected list. Once you are happy with Continental Chemistry on the right hand column, click *OK*.

14. You are now on the *Select Map* screen. As usual there are some hint buttons on the page. Use these buttons to discover what a particular selection represents. Kamloops can be plotted on the West Coast map, so click that button, then click *OK*. Lots of stuff happens behind the scenes: MSAccess does some selecting of data, then gets it ready to export to QUIKMap. Some data translation occurs, then the QUIKMap program is started in a window, and the exported data eventually appears on a map of B.C. (See example map on next page).

15. But wait! We specified the Thompson Sub-Basin and there are dots all up and down the Fraser! What is going on? Don't panic. This is not a bug, but a feature of the metadata. Some of the datasets with locations in the Thompson Sub-basin also have locations outside that Region. This is simply extra location information displayed.

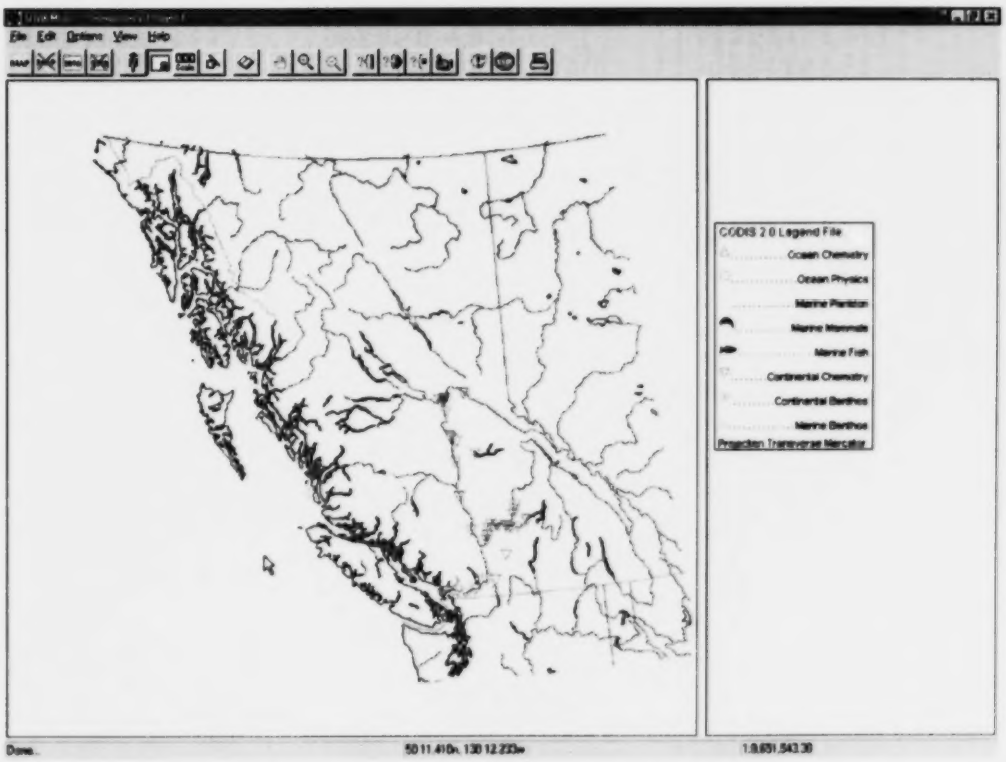
Note - if you are running Windows NT, you may get a message that reads "The system cannot open COM_ port requested by the application". Just click on *Ignore*, this may have to be repeated several times depending upon how many COM ports your PC has, until the QUIKMap application opens. We believe that

this is only a Windows NT problem but it may also manifest itself in other operating systems.

16. QUIKMap does a number of useful things. You can Zoom in on an area. You can place a legend (*Alt L*, move the box with the mouse, *<Enter>* to freeze it). You can get some idea of which dataset is where (move the mouse close to station location then press *E*, QUIKMap searches and then displays the data associated with that point on the map. There may be more than one dataset as some stations will overlap. You can print hard copy, save the file, etc. When you are done, do *File, Exit, Yes* to return to the Level 1 search screen.

17. IMPORTANT: You must exit QUIKMap before attempting to build a second map from CODIS. If you do not do this CODIS will give you a couple of chances before it does your bidding and locks up.

18. That's it for this time. Stay tuned for a more detailed search in the following sections.



Example of CODIS map output using QUIKMAP

5 Scoping the CODIS contents

This section of the guide starts a review of CODIS, form by form, beginning with the main menu. Other sections will follow, with some worked examples interspersed.

5.1 Navigate the *Main Menu*

The Main Menu form has the first example of a *Hint* button. Press this button to get a quick reminder of the function of the current form. There are six buttons on the Main Menu. They indicate the six option groups available to the CODIS user.

- *Learn About CODIS*

Text about CODIS: where the data came from, how data quality was appraised, this User's Manual, how the database is structured.

- *View Regions* and *Dataset History:* Map views of regions defined by CODIS and takes a look at the overall dataset history.
- *Search/Report/Map Datasets:* Search and reporting function of CODIS
- *Add/Modify Datasets:* Dataset entry and maintenance.
- *Manage Search Tables:* Deletes old search results.
- *Manage CODIS:* Modify CODIS tables.

5.2 Explore Learn About CODIS

The button *Learn About CODIS* on the Main Menu is the entrance point to a structured set of files (*.txt in the "Text" sub-folder under CODIS2) that can be accessed from menus within the MSAccess database. The *Learn About CODIS* button moves the user to a screen of options for the possible text subjects. Each of these can be pressed in turn. On each selection, except Inventory Status, a MS Word file is opened containing information on the selected topic. To open these files you must have Microsoft WORD installed on your machine. To exit these MS Word windows, the *File, Exit* option is used. Inventory Status is a MSAccess Report file, to exit this file click on *File, Close*. Any text that is edited during this view will be kept in the "Text" sub-folder outside of CODIS.MDB. These text files can be printed, if desired.

The organization of information under *Learn About CODIS* is, as follows:

Purpose and Scope
Sponsors and Funding
Inventory Status
Approach
  Compiling, Appraising, Archiving, and Querying
  Data Rating
    General Scheme, Continental Benthos, Continental Chemistry, Ocean

Physics, Ocean Chemistry, Marine Plankton, Marine Benthos, Marine Fish, and Marine Mammals
User Guide
Data Dictionary

5.3 View *Regions* and Dataset History

This form shows PCX files that illustrate the extent of geographically defined regions in CODIS. This is intended to provide a quick glimpse of where each region is located. The map choices on the View Regions form are evident. They are grouped in Pacific and Arctic categories. Click on the region you would like to view. A CANCEL button controls return from the view of a Region.

List of Regions available for View:

Pacific
- Georgia Strait and Adjoining Waters
- Fraser River Estuary
- Lower Fraser River Basin
- Middle Fraser River Basin
- Upper Fraser River Basin
- Thompson Sub-Basin
- Nechako Sub-Basin
- British Columbia Offshore to 200 miles
- Queen Charlotte Sound/Hecate Strait

Arctic
- Canada Basin / Arctic Ocean
- Canadian Beaufort Sea
- Northwest Passage
- Queen Elizabeth Islands Region
- Baffin Bay

These Region maps highlight the environment in which CODIS 2.0 has developed. Some Regions clearly have geo-political boundaries. Others are tightly defined by geographical factors, for example, the Fraser River. There is also a Canadian and American interface, particularly in the Strait of Georgia and in the Western Arctic. As a result, the Regions have unmatched sizes and the length to width proportions are variable. Dataset characteristics will depend on the geography and on human events in these regions. Data density also depends on the collected information in historical terms. The regions represent approximately equivalent amounts of metadata in disciplines. There is a feature in this version of CODIS 2.0 that enables one to view the historic accumulation of datasets. This can be accomplished by clicking either on the *View Graphs* button or on a specific discipline as you view each region.

5.4 Manage Search Tables

When CODIS searches are made (Level 1 or Level 2 search) the result is stored in a table in the database. The MSAccess system of managing tables is to include them all under the umbrella of one file. The result is one large file, CODIS2.MDB. The normal operation of CODIS 2.0 results in an accumulation of search result files and the umbrella CODIS2.MDB file will grow in size. This can add significantly to the computer overhead in CODIS 2.0 as well as chewing up free disk space on a hard drive. The "Manage Search Tables" function displays all files created by the search buttons in CODIS 2.0. These tables can then be removed on a one by one basis by clicking on the search file name.

We recommend doing this regularly. Following this cleanup, it is a convenient habit to compact the database, which frees disk space used by the CODIS2.MDB file that was used by these tables. Compacting does other useful things, for example, if records have been added or deleted in tables, these tables are tightened up. Refer to Section 2.2 for CODIS tips on backup and COMPACTing.

6 Searching for Datasets at Level 1

The Level 1 search form is designed to present structured choices for searching CODIS 2.0. The *Hint* button provides an overview of how to "Build a Level 1 Query". If the *Hint* button is clicked, the displayed message will provide a reminder of the Level 1 search features.

Possible searches include:

- One or more regions selected from a pick list: If more than one region is selected, they may be chosen to be in an AND or in an OR relationship. The OR relationship is the default relation across regions. The AND relationship will search for the intersection of two regional sets of data. Datasets of larger regional scope are found using the AND relation. If no Region is selected, then all regions will be considered.
- One or more disciplines selected from a pick list: If more than one discipline is selected, they may be chosen to be in an AND or in an OR relationship. The OR relationship is also the default relation across disciplines. The AND relationship will search for the intersection of two disciplines in datasets. Datasets that span disciplines will be found using the AND relation. If no discipline is selected, then all disciplines will be considered.
- A start date and/or stop date: These are the beginning and end points of the data collection. If only a start date is selected, then all datasets with collecting periods that start after the start date will be considered. If only a stop date is selected, then all datasets with collection periods that ended before the stop date will be considered. If both start and stop dates are specified, then datasets will be selected which start on or after the specified start date AND stop on or before the specified stop date.

A text string under Save *Search Results* is required before the *Search* button is pressed. Spaces are not allowed, nor is most punctuation. This text is used as part of the name of a table that is created, and can be up to 256 characters long. CODIS 2.0 uses 8-12 of these, so you are limited to about 245 characters (without spaces or punctuation!). This table can be restored and reused later. It is a good idea to have some information in the search name that will allow you to recognize it later. *Search1*, *search2*, and *my_test_search* will work, but they are too cryptic for long storage purposes. We usually put in some information on the scope of the search. For example, *MM_GS_1985to1990* might be a good name of a search that selected marine mammals metadata for the Georgia Strait region between 1985 and 1990.

When the *Search* button is pressed, the computer generates SQL (Structured Query Language) representing the choices. A search is made. Matches are found. The result table is created.

After a query has executed (i.e., *Search* has been pressed), the *Report*, *Map* and *Preview* buttons will darken up. They become functional only after a query has been made or restored. Proximity is a hidden feature that has not been activated in this version of CODIS.

6.1 Refine the *Search* terms

The following examples work from the most general query and increase the detail until focus on a few datasets (with specification) is achieved.

A search can be designed that has:

- **Only a search name.**

If the search name (e.g., "ALL") is typed and the *Search* button is pressed, the world will not end. But it may seem to for the software at hand. This is because this search will generate a huge result file of all datasets. If the platform is strong enough (RAM, processor speed, free disk space, etc.) the search will execute. One might even proceed to the Map or Preview functions. The Reporting might be glacial (minutes) in terms of response time. Perusing these ideas might be interesting, however, in light of seeing the machinery of the database and getting a feeling of what CODIS 2.0 is expected to produce. Please see the notes on maintenance. Running this query will impact the size of the MSAccess file significantly. As they say, "performance may be negatively impacted".

- **A search name and only one discipline.**

By clicking on the selection box arrow for discipline, the list of disciplines appears. A single click on one of the options will identify that discipline in the *Selected Discipline* box. Entry of a search name, as before, and a press of the *Search* button will generate a table that is big. This might be more useful than the first effort noted above, but it is still unwieldy and likely is not our preferred task. One might generate a report of all research in a discipline by this route.

- **Only a selected date range.**

An example date range would be 1/1/74 to 1/1/75. Entry of a search file name (any text) and press of the *Search* button will generate a result table: "What is in the database regarding this time period - 1974?" Please see the date rules above. By default, CODIS 2.0 assumes that a two digit code for year refers to the 1900's. In this case 74 is perceived as 1974. To get data from the 1800's you must enter 18 followed by the two digits, for example, 1824 or 1896.

- **Only a region.**

In a parallel presentation to that in discipline, a region can be selected. By selecting one of the listed regions, entering a search name and pressing the *Search* button, CODIS 2.0 will return all data for that region.

- **Only a dataset ID.**

The dataset IDs have an obvious structure, so can be used to do a search related to date. Alternatively, this feature can be used to isolate a known dataset for other searching.

- **Any combination of criteria.**

Implicit in the above is the idea that all sections of the Level 1 search form function independently. Implicit in the examples presented in the "Quick Tour" is the idea that combinations of criteria are combined in an AND relationship. If one discipline is selected together with one region, then datasets will be selected which fit the discipline criterion AND the region criterion. The disciplines and regions act independently, so a query of the form (discipline 1 AND discipline 2) AND (region 1 OR region 2) is possible.

6.2 Press the *Search* Button

What happens with you press the *Search* button? The short answer is: "A table of results is generated". These tables from queries accumulate in the database and must be administrated by the user (see Manage Search Tables on the Main Menu).

In more detail, the selections on the screen are absorbed using Access Basic that is started by the "event" of a button click. The software creates SQL at the viewing time (which unfortunately is not as fast as canned SQL). The SQL is just a long string that is readable by humans but can be tricky to see details in. The MSAccess JET engine grabs this thing and does the work of selecting datasets. The SQL from the search screens is not stored, it is just created as needed from the form. Once the SQL has executed, a result table is written to the database for use in subsequent actions.

6.3 Press the *Restore* button

When the *Restore* button on the search screen is pressed, a form is presented that lists the result tables of previous searches. These results are stored indefinitely in the database. Their presence can be managed by following the actions on the main menu under the button *Manage Search Tables*.

A click on an item in the List Box will give a message regarding the number of datasets in the result table. If this result is wanted for review, then the *OK* button will transfer focus back to the search form. The restore terms of the old query are now in the search form, exactly as they were when the query was originally made.

6.4 Press the *Preview* button

After a search has been made or a result from a previous search has been revisited by using the *Restore* button, the *Preview* button is functional. It brings the selected datasets from the search into view on the *Preview Datasets* form when it is clicked.

Under the form header is a summary of the search criteria that were used. There is a *Hint* button to sketch the options available on this form.

Near the middle of the form is a *List Box*, an alphabetically sorted list of dataset identifiers (DS_IDs), together with a brief description of datasets that were selected. A mouse click on any entry in the List Box will select one of these entries. A view of the details of that dataset is then presented on the lower portion of the form.

The discipline buttons on the lower right of the Preview form will change appearance in response to each dataset selection. (So clicking in the List Box for another dataset may change the appearance of the discipline buttons.) The default view is for the topmost active discipline button for the selected dataset.

A dataset may have information in several disciplines, in which case, the buttons for discipline display the active discipline choices. Click on the target beside an active discipline button to view information for that discipline (in the current dataset).

The disciplines are:

Continental Chemistry	CC
Continental Benthos	CB
Ocean Physics	OP
Ocean Chemistry	OC
Marine Plankton	MP
Marine Benthos	MB
Marine Fish	MF
Marine Mammals	MM

The information that is displayed for a selected dataset:

Area and Region
Parameter
Measurement in most disciplines, or Constituent in chemistry
Taxa in most disciplines, or Media in chemistry
References [note: click on a reference for the full "message box" view of that item.]

6.5 Press the *Map* button

CODIS requires some preamble before getting a mapped view for those datasets found in a search in CODIS. The mapping set up requires details about the base map, projection and features for display. Use of the *Map* button begins this process.

The form that shows up is *Map Datasets by Disciplines*. Once again, a list of available disciplines is presented. The map disciplines that should be selected likely will match those in a search. However, one might want (for example) to display benthos data in some datasets selected from a chemistry query. So any of the disciplines may be chosen for mapping, even those not in the original search. Alternatively, only a specific discipline subset might be selected from a multi-discipline search. Choices are made by clicking on the discipline names.

Pressing the *OK* button will continue to the *Select Map* form with further details.

The *Pick a map below:* group allows three options. The North America and West Coast maps are just the base maps supplied by QUIKMap. The Arctic option is a custom view taken from the North America base map.

Below the map selector buttons are three other selections: "*Include Areas*", "*Include Polygons*", and "*Include Transects*". Each of these options has its own *Hint* button.

The *Include Areas* toggle button has a default value of *NO*. This *Include Areas* mapping is one of the newest features in CODIS. It came about because most CODIS datasets usually have precise locations (latitude and longitude, exact notations of stations, polygons or transects). However, some of the recently added data has an "area" flavour that lacks this precision and therefore they will not be displayed on a map of stations. Selecting the *YES* toggle button will show datasets that do not have the latitude or longitude specified and instead give an area specification. These areas appear as a large "+" on the map.

Selecting *YES* for the *Include Polygons* option will plot a standardized polygon for each Arctic dataset without known stations or transects.

Selecting *YES* for the *Include Transects* option will plot those data in the Marine Mammal and Ocean Physics data bases that have transects.

There is a computation crunch here for CODIS if the *Include Areas* option is chosen. The logic is that where we have detailed station, transect and polygon data, the actual data will be used. If the toggle button *YES* is chosen, the computation required is to look for those that are exceptions (i.e., no latitude or longitude information) and, if appropriate, add them to the mapstns.dbf file sent to QUIKMap. All eight discipline XX_STNS tables are then searched. This takes some time, perhaps a minute. It does not do any damage, but it has a "negative impact on performance".

Once all option choices have been made, the export of the Mapstns table to QUIKMap can begin. Pressing the *OK* button at the bottom of the Select Map form starts the procedure. CODIS produces a table Mapstns that is exported to Dbase IV as a file named mapstns.dbf. Then QUIKMap 5.0 is started and the file data is layered on the chosen map. There's stuff to see on the screen as this marches forward. You will eventually see the map with station, polygon, and transect information on it. You can use QUIKMap to alter the view, print the map, export it, etc. See the QUIKMap manual. [Note: CODIS2 does not go away at this point but remains in the background. You may move back and forth between the two programs but must close QUIKMap before generating a new map from CODIS2.]

CODIS designers have selected a distinct symbol type for each discipline when these are mapped. A legend can be displayed as follows., Once the map is in view, press *Alt L*. Use the mouse to place the box in an open location on the map and press *Enter* to fix it in place. A legend will be added to indicate the symbols used by each discipline.

At each location of the symbol on the map, the data for the site can be reviewed, so that the dataset can be identified with a particular site. The data can be displayed either as follows. Once the map is in view, press *Alt E* followed by *Enter*. *Page Down (Up)* will take you through the various records. Escape (*Esc*) brings you back to the map. QUIKMap will churn through the mapstns.dbf and mapstns.dbt files to find the station(s) closest to the mouse pointer. It will then offer you a choice of file(s) to open. However if you want the particular station, move the cursor to the station and enter *E* followed by *Enter*, and once again move around using the directions on the screen.

There is much more detail in QUIKMap than presented here. The QUIKMap Manual is your best source of information. The manual is available for install from the CODIS2 Evaluation CD. Please refer to the instructions on screen.

6.6 Press the *Report* button

The *Report* button on the Level 1 search gives a screen view of a report on results from a search. This report can be printed. When the *Report* button is pressed, an intermediate form is presented for selection of one discipline for the report. The Level 1 search may select more than one discipline (and datasets can span several disciplines) but the reporting is tailored to single disciplines. After this selection, construction of the report is automated. You arrive (eventually) in the print preview mode of MSAccess and can navigate using the tools on the screen (zoom in/out, page forward/back.) Close the print view screen to return to the previous CODIS2 Screen.

The discipline reports have similar structures. Features of the reports include:

- Report header

- Query name
- Discipline - Date of report
- Dataset information
- Parameter(s)
- Measurement(s)/Constituent(s)
- Reference(s)
- Cataloguer's Comment and Status
- Concurrent Information in CODIS

Some features of the reporting have been very challenging to implement. Behind the scenes there is a tremendous amount of logical control required to avoid the combinatorial explosion of relationships between the different types of information stored in CODIS. Some of the flavour of this problem is discussed in the section on "Design of Custom Queries". Once the correct set of information has been selected, MSAccess needs to be coerced into a compact presentation. We have chosen to write some code to achieve this task, as the MSAccess Report Writer isn't up to the job. As one example, Parameter(s) and Measurement(s) are printed as concatenated strings that result from the values in data tables. This string is then passed to MSAccess to build into the report.

7 Searching for datasets at Level 2

Welcome back. This tour assumes you have done the Level 1 Quick Tour, and you have a file called "my_test_file" with 16 Continental Chemistry dataset IDs from the Thompson River region in the late 80's. We will want to refine the search to locate datasets with information about 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD, 2378) in sediments. Along the way we will also look at geographically restricted searches, for example, selecting only data from along the North Thompson river.

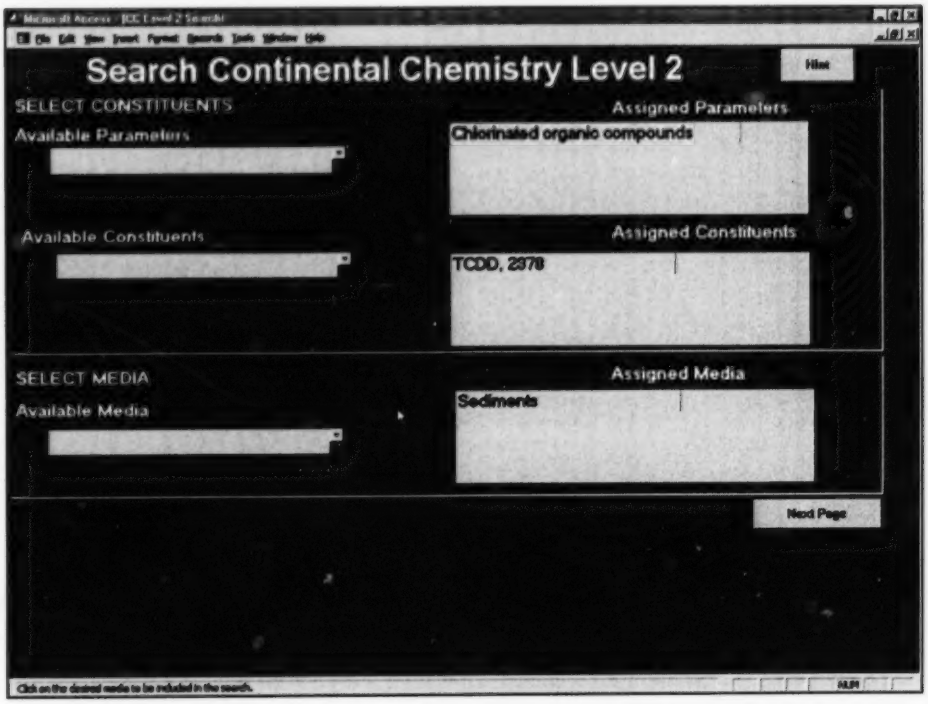
1. From the main menu click *Search/Report/Map Datasets*, and on the Level 1 search form *Restore* "my_test_file". Click the *Go to Level 2* button. This moves the focus to a discipline selection form. Click *Continental Chemistry*.

2. The focus shifts to the *Search Continental Chemistry Level 2* form. Like the other Level 2 search forms (Continental Benthos, Marine Fish and Marine Mammals), this form has a couple of pages. On the first page click on the *Parameters* box to open a pick-list of the nine possible parameters. Click on *Chlorinated organic compounds*. This shifts this parameter onto the list of *Assigned Parameters* on the right-hand side of the form. You can remove a selected parameter by clicking on it.

3. With the *Chlorinated organic compounds* parameter as the only item in the selected parameters list, click on the *Available Constituents* box below to open a pick-list of constituents. Scroll down this list until you find the dioxins/furans section and find *TCDD,2378*. Click on it to move it to the *Assigned Constituents* space on the form. You can remove it by clicking on it if you wish.

4. As an aside, return to the *Available Parameters* pick-list and selected another parameter, for example *Hydrocarbons*. Now open the *Constituents* pick-list and note that your choices have changed. CODIS will present only the constituents of the last selected parameter. In the other disciplines, the same will apply to parameters and measurements. The selection can involve parameters, constituents (measurements), or a combination. The selections are related by OR logic. Remove *Hydrocarbon* by clicking on it.

5. Click on the *Available Media* box to open a pick-list, and select *Sediments* to the right-hand side of the form. Your form will look like the picture below,



Screen showing the Continental Chemistry Level 2 form, ready for a search.

6. Shift the focus to the *Next Page*, and fill in a search name such as "my_test_level2". Press *Search*. Stuff happens and CODIS reports that 3 datasets fulfil the search criteria. The indicator targets under the search name light up to show that the search selected parameter, constituent and media terms. Press *OK* to light up the *Map*, *Report* and *Preview* buttons. The precise terms are too complex to store, but these general details are stored with the result table. The *Map* and *Preview* buttons work in exactly the same manner as they did on

Level 1.The reports are a bit different at Level 2 than at Level 1. Click the *Report* button to open a form to select the type of report you want. Since this is in the Continental Chemistry discipline, only the Continental Chemistry buttons are highlighted. The same types of reports are available in the other disciplines. The *Summary Report* is exactly the same format as the Level 1 Report, with the refinement that only the three datasets which met the selection criteria will be printed. The *Station Detail Report* gives a list of latitude and longitude of each sampling station in each dataset. The most detailed report is the *Measurement Detail Report*. Press the button. Time passes, and the view shifts to the *Print Preview* function of MSAccess.

A section of the report is shown below.

CONTINENTAL CHEMISTRY MEASUREMENTS REPORT

26-Nov-01 **Search File Name:** *my_test_Level2*

Dataset ID 19885023F

	Rating Comments	Rating	
Sampling	Acceptable	4	**Overall Rating**
Storage	Acceptable	4	
Analysis	Inland Waters Standard Methods	4	3
Accuracy	Consensus Reference Material Not Available	3	
Precision	Acceptable QA/QC	4	
Remarks	Includes one or more composite samples		

Parameter Chlorinated organic compounds **Constituent** TCDD, 2378 (2,3,7,8-tetrachlorodibenzo-para-dioxin)

Medium Sediments

Measurement Units pg/g

Measurement Method

# of Stations 1 **# of Samples** 3

Rating ID 1CC3009

Detection Limit (d.l.)	# less than d.l.	Minimum	Maximum	Mean	Median
15	0				

Note that the report above is quite short, only three pages containing three groups of information for the three datasets. That is because we selected the constituent TCDD,2378 in sediments. Only those items which match the search criteria for parameter, constituent (measurement) and media (taxa) will be reported. The actual text information presented is self-explanatory. This information applies to the dataset as a whole, so data on individual samples is not presented.

8. It will be useful to review the other types of search capability available at Level 2. Click *Close*, then *CANCEL* to shift back to Page 2 of the Search Continental Chemistry Level 2 form. This page shows two other types of search criteria. On the lower left side of the form is a box *Select Data Quality*. This section accepts numerical input for minimum and maximum values of data appraisal (rating from 0

to 4) in the five detailed sections of the measurement (Sampling, Storage, Analysis, Accuracy and Precision) as well as an *Overall Quality* rating.

9. Above the data quality section is a *Select Area Coordinates* section. There are three choices here. If you know the latitude and longitude coordinates of a desired search area, you can enter them directly on the left/center section of the form. Alternatively, if you want a rectangular area, but don't know the coordinates, you can use QUIKMap to find those coordinates. That function is under the *Select Rectangular Grid* button.

10. The third and most flexible choice is under the *Select Polygon(s)* button. Press it to open a comment on the process you will follow. Press *OK* and go through the transfer to QUIKMap. The map appears with the Level 1 station locations. Suppose we wish to isolate the stations in the Thompson River drainage from the Fraser River stations. Move the mouse pointer to near the Thompson-Fraser junction and press *P*. QUIKMap may prompt with "Data file to use:" enter *polygon.dbf <enter>*. QUIKMap follows with "Key or <Enter> for new:" We want a new key, so press *<Enter>*. A scale description appears at the bottom of the screen and the mouse is active. Click positions around the stations on the map to describe a multisided polygon. When you get near to where you started, press *F2* to close the polygon. A closed figure will be plotted.

11. Using the QUIKMap menubar do *File, Save* and give your polygon a "New Key" name such as "my_test", *<Enter>*. Move the mouse pointer to inside the polygon and press *I*. QUIKMap searches the displayed information to locate the polygon ("1 symbol found"), then locates all stations within the polygon and "tags" them. There is a series of "beeps" during this process, and QUIKMap finally reports that "37 stations have been tagged" (depending on how you drew the polygon). The last step is to exit QUIKMap (*File, Exit* or *Alt X* and answering *Y* at the confirmation prompt).

12. Nothing has apparently changed, but executing a search will add a statement to the SQL which tells CODIS to find datasets with tagged stations from the Mapstns table. The way we have done this, the search is not going to give any different result from the previous search as we still have the Parameter/Constituent/Media selections active on Page 1. But you get the flavour. If you want only area constraints, then go back to Level 1 (with the *Return to Level 1* button), then come back and repeat steps 10 and 11. This will set up an area based search.

13. Enjoy playing around. There is interesting additional functionality for species under the Continental Benthos button. The possibilities are described in section 2.3.3 of this document.

7.1 Use Level 2 Forms

These notes continue the form-by-form survey. Having completed a query, the *Go to Level 2* button is no longer grayed out. Level 2 searching depends on the results of the Level 1 search, and uses a Level 1 result table as a point-of-departure.

Pressing the *Go to Level 2* button brings a *Search Discipline* form into view. This form identifies the four disciplines currently available for Level 2 searches. Each discipline has specific Level 2 structure, which is reflected in the four distinctive forms for Level 2 searching.

The Level 2 search criteria imply that detail, structure and searchable fields exist in the data tables for each discipline. CODIS holds more data than is currently searchable at this level. See advanced examples on how to get at this information.

The disciplines are underlined below, for which Level 2 search function is implemented:

Continental Benthos	CB
Continental Chemistry	CC
Ocean Physics	OP
Ocean Chemistry	OC
Marine Plankton	MP
Marine Benthos	MB
Marine Fish	MF
Marine Mammals	MM

The four discipline Level 2 search forms are similar to the Level 1 search form in several respects. Many of the footer buttons are parallel in design. The header region in each discipline contains a *Hint* button. Each search will require a search name and a table of results will be entered in CODIS.

The Level 2 forms each have several pages, as opposed to the single page format for the Level 1 search form. These pages can be flipped in sequence by pressing the *Next Page* button. The current query details are held on each page while the query is built, moving through these pages several times is expected.

Each Level 2 search form has sections in boxed outlines. These are groupings of related search details. These sections have text headings above the box. In general, a search probably includes only one or two selections of the many groups of constraints available. A search does not require every grouping be used, since no choice simply means there is no specification in this area. These selective queries that can be built here will search the datasets in a wide variety of ways.

7.2 Query by Parameters and Measurements

Available Parameters: If the mouse is moved to the arrow at the right of the selection box and clicked there, the list of parameters will be displayed in a pull down menu. One of these entries can be selected by a click on the entry. The parameter will be placed in the *Assigned Parameters* box and CODIS software will activate the *Available Measurements* box based on the parameter that has been selected. [Note that *Constituents* on the Continental Chemistry Level 2 form are the equivalent of *Measurements* on other Level 2 forms.]

The measurements that can now be displayed using the pull-down menu are specific to the parameter that has just been selected. The measurements displayed are different for each parameter selection, since measurements are subgroupings of a parameter. None, one or several measurements may be chosen. If none are chosen, all of the parameter groups are searched. For one or several measurement selections, the detailed subgroup is searched explicitly. The parameter list can be revisited and another entry selected. The measurement list is reset by CODIS software. Appropriate subgroup choices can again be made.

7.3 Query by Area Coordinates

Three approaches to the Area selection can be made.

Important:You must first produce a map of your data from the Level 1 search form before proceeding to do a map output from a Level 2 search.

First, if the "box" of latitude and longitude (lower and upper bound for each) is known, then the values can be typed in the text boxes.

Secondly, if the shape of the desired area is rectangular but its coordinates are not known, a box can be generated in QUIKMap. These values will be returned from the map into the search form as latitude and longitude values. This is selection of area by visual inspection of the map. A click on the *Select Rectangular Grid* button opens a text window with instructions, and on *OK* proceeds to QUIKMap. [Note: your current data will not be plotted, you will just have a base map to find your coordinate.] Use the *Zoom* function of QUIKMap to select the desired search area, do *Shift F5* to save the windowed coordinates, then exit (either use the "Alt F4" or File, menu and answer "Ok" and "NO" to the 2 dialog boxes) to return to CODIS. Immediately upon your return, the selected coordinates appear in the latitude/longitude boxes.

Finally, a polygon (any shape with linear sides) can be defined using another QUIKMap feature, and dataset stations/transects/polygons inside this can be "tagged". This result can be brought back from the map software for entry in a search. The process is similar to the area search, but uses the locations available from the Level 1 search. A click on *Select Polygon(s)* gets some instructions, and *OK* gets you eventually to QUIKMap with the available stations indicated.

A separate dialog box will appear in CODIS to halt the program while you set up your "tagged" data in QUIKMap. Do not close this box until you have finished in QUIKMap and closed the program.

Zoom using the zoom tool (a magnifying glass with a "+" symbol in it) to get a view you like, then activate the polygon feature pressing "*P*". QUIKMap wil prompt with a dialog box "Data file to use:". Select *polygon.dbf and click on "OK"*. . Use the mouse to draw a polygon around the stations of interest clicking at each interstice ,close the polygon by pressing *F2*. Save the result by selecting <save line + quit> from the file menu or by pressing *F10*. A *New Key* dialog box will appear, use any alphanumeric character for the key, click on <OK>. You still need to "tag" the stations inside the polygon. Do this by selecting <Query/Tag data> from the view menu and the appropriate tag option from the subsequent drop down menu.

Using the now modified mouse pointer click inside the polygon, you have just drawn and saved. Stuff happens and you get a report of the number of tagged stations. Click <OK>. Exit QUIKMap (*by selecting <exit>* from the *file* menu, click <OK> and <NO>. The map information is transferred back to CODIS. Once you have been returned to CODIS click <OK> on the message box, wait for a moment and new message box will appear to tell you that CODIS has collected the tagged data. The search now will look for the tagged stations as part of the selection criteria.

7.4 Query by *Taxa*

For disciplines with short species lists, this works just like the Parameter - Measurement function. The benthic taxonomy provides another Level 2 search option in Continental Benthos.

Begin by choosing a phylum. Clicking on the arrow at the right of the phylum box expands the list of worms, mollusks, etc. A selection by clicking on one of the entries offers two choices. The whole of the phylum could be selected now by clicking on the *This Phylum* button. Alternatively, the classes in the phylum are now activated. The logic here is parallel to that in parameter and measurement, that is, only the classes in the current phylum are visible. The classification structure can be walked through order, genus, species, to the point where a particular animal can be added to the search list. Alternatively, mixed groupings of phylum, or class or other sub-(sub)-groupings is acceptable in the query. The search could be for "a phylum or a species" for example. Deletions can be made from the selected text box by clicking on the entry. The entries can be tuned up after some trials of adding taxon specifications.

The Continental Benthos taxonomy table in CODIS has more than one thousand entries of variable specificity. This is an abstract of benthic taxonomy that is functional for the datasets in hand. The structure of the taxonomy in CODIS

anticipates the needs in these searches in the other "biological" disciplines. Hence, the data is in the tables but is not implemented in the software.

7.5 Query by *Methods*

Instrument Methods are just a pull-down list of instruments as they have been catalogued in the CODIS tables.

7.6 Query by *Water Depth*

Some stations contain data taken below a water surface. The Level 2 search screen allows a search in a depth range. If only the minimum depth is entered, the search is for all depths greater than the value. A maximum depth can be used to find all stations at depths less than the value.

7.7 Query by *Data Quality*

There are four or five aspects of measurement rated and one overall rating for a total of five or six search fields relating to quality. At this writing, only the "Continental" disciplines utilize all fields, but all datasets have an overall rating. Data appraisal, and the meanings of the ratings are discussed elsewhere. The minimum and/or maximum values for each (or any) of the ratings can be entered. Similar to other range selectors on these forms, if only one of the pair is entered, all values on one side or the other of the value are returned.

7.8 Choose your Search Result Name

Search Result Name is a text string as in the Level 1 search that identifies the table in CODIS that results from the search. CODIS uses the Level 2 string differently from the Level 1 so that the disciplines are identified in the table name at Level 2.

7.9 Press the *Restore* button

The *Restore* button feature is similar on the Level 2 discipline forms to the performance on Level 1. The list of tables from earlier Level 2 searches contains only searches in the current discipline, i.e., you will not see Level 2 mammals searches in the fish Level 2. Search details are not retrieved because they are varied and complex, in other words, too varied to be worth saving. The result table retrieved cannot be used to "back up" to Level 1, or as a basis on which to re-design a Level 2 search. It can be used to map or report.

7.10 Note the *Discipline* indicator buttons

Indicator buttons are placed in the *Save Data* area. There is one for each of the group box outlines on the discipline form. These indicator buttons have darkened

centers after a restore to indicate which general area of the discipline was specified in the search.

7.11 Press the *Preview* button

This works exactly the same way as it did on the Level 1 form.

7.12 Press the *Report* button

A selection of report choices is displayed, but only the appropriate discipline choices are active. A *Summary Report* will be identical to the Level 1 report, pruned down by the additional selection criteria of the Level 2 search. The *Station Detail Report* gives a simple listing of dataset identifiers and the station latitude/longitude of every station associated. The *Measurement Detail Report* gives all the available metadata with respect to the measurement, to the highest level of detail known to CODIS. The data reported is constrained by the Level 2 search.

For example, if the Level 2 search specified a particular species, then only the measurements involving that species would be reported. Similarly, if a particular chemical constituent was specified, then only that constituent would be reported. CODIS might well contain other information in the same dataset for other species or constituents, but this would not be reported.

8. Modifying existing datasets

The purpose of this tour is to show how the *Modify Datasets* function works for entry of new CODIS information. All dataset specific information is entered using the *Add/Modify Datasets* button. This function includes both modification of existing data, and entry of new data. Information used by many datasets, such as the lists of Parameters, Measurements, Areas, or References, uses the *Manage CODIS* function. The input of data involves selecting a dataset (or creating a new one), and attaching data to the dataset. It is easiest to attach everything all in one session, but it is not essential. You can do some input, and come back to the same dataset and add more later. The only step you will need to repeat is the dataset selection. [NOTE: You are working with the "live" data. Do you have a backup of the "clean" database? If not, why not?]

8.1 Select a *Dataset ID*

1. Click *Modify Datasets*. The *Find Matching Dataset IDs* screen prompts you for a Start and End Date. This is a selection tool at this point but will appear in your new Dataset ID later. It can be modified then if necessary. If you do not want to make too much of a mess in the database, use 1/1/1999 and 12/31/1999 as choices.

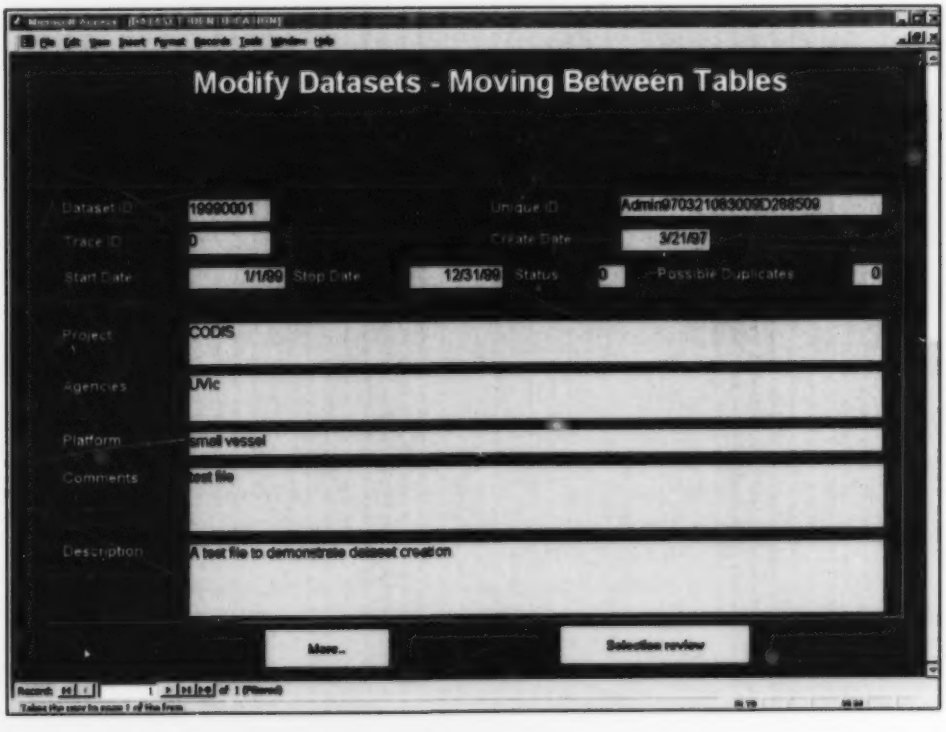
Once you have some dates entered, click *Find Possible Match*. CODIS will give you a list, longer or shorter depending on the dates. The list is displayed on a *Dataset Selection* screen.

2. If you are selecting an existing Dataset ID to modify, you need to click on it in the list. The scroll bar on the right allows you to navigate up and down. Alternatively, click the mouse on one of the Dataset ID boxes. This will tell MSAccess you are interested in that field. Then on the MSAccess upper menu, click *Edit*, *Find*, and a dialog box will appear. Type the Dataset ID you are looking for into the *Find What* box, and click *Find First*. Access will shift the pointer to the correct entry in the CODIS list. You need to *Close* to get the dialog box to disappear. Once you have found the right Dataset ID, click *Go To Dataset ID*. There is likely a few choices for 1999xxxx. Choose one.

3. If you are sure you are entering a brand new Dataset ID, click *Create New Dataset*. The *New Selection* button takes you back to try another date range if you don't like the list presented.

8.2 Get started with a pre-existing *Dataset ID*

For illustration, we chose 19990001 from the list we had in the previous section. The result is illustrated below. This is obviously a nonsense Dataset ID so yours might



look different. You can see the data already here. All of it can be modified except the Dataset ID and the Unique_ID (a machine number that is truly unique, unlike the dataset ID which must allow duplicates to make up for problems from the past). The fields are fairly simple to work with. Just click where you want to type, and then away you go. Some attention to standard formats would be useful if you intend to enter lots of new data. The most recent datasets, for example Marine Mammals in the Georgia Strait Region, illustrate a good control over the use of the available fields

8.3 Identify the fields and their uses

From the screen on the previous page, we can see that:

- *Start Date* and *Stop Date* refer to the Dataset ID as a whole.

- *Status* and *Possible Duplicates* are flags a cataloguer can use to keep track of datasets and dataset entry. Make up your own code.

- *Project* is a text field that can be used if the data comes from some named program, e.g., Beached Whale Program.

- *Agencies* includes the sponsor and any other agency or NGO that was involved in the work.

- *Platform* is the boat, airplane, etc. (or location like a light house) used for the measurements and observations.

- *Comments* are used for the cataloguer to note anything that is helpful to another cataloguer or someone looking for that data. It is more qualitative that a bibliographic citation, and will allow you describe the source in detail. For example, "This data comes from Joe Blogs' files on audio tape as discussed in Betty Smith's thesis"

- *Description* is a useful summary of what the data are about as a whole. This is used for the fast preview functions of CODIS so it needs to communicate the essentials in a short phrase.

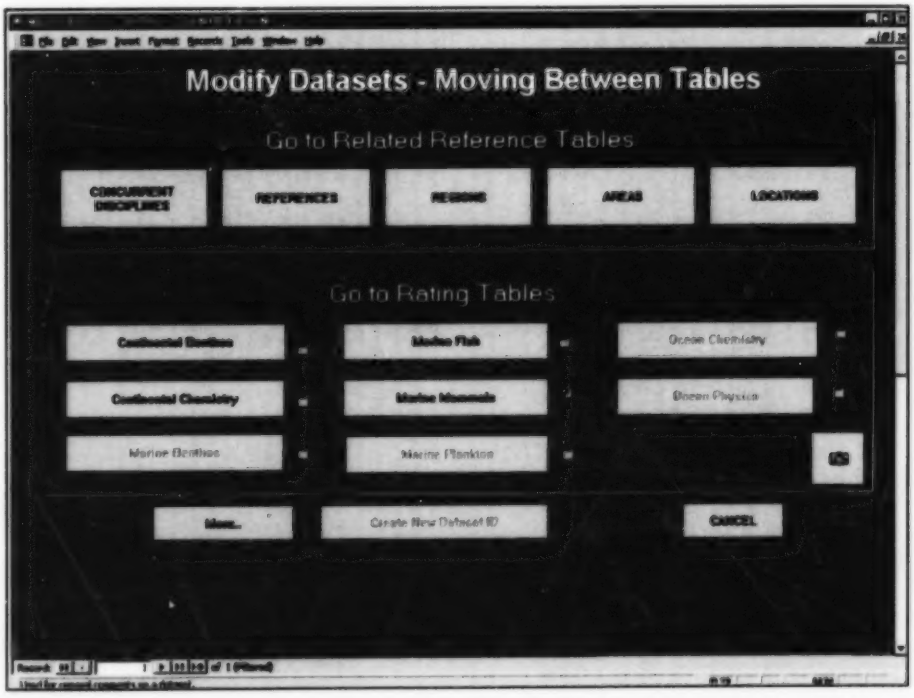
-The *Selection Review* button takes you back to your Dataset ID list again. This allows you to explore the list a bit.-The *More* button moves you to a screen that permits you to move between Tables while maintaining your selection. See the example on the next page. Since this is a nonsense Dataset ID, your screen may look different. On our version this is a Marine Mammals dataset and there is an *X* next to the Marine Mammals button, but the other similar boxes are blank. The *More..* button on this form takes you back to the descriptive information. The *CANCEL* takes you back to the CODIS main menu.

8.4 Get a new dataset started

The process is very similar to the one just described. All the fields are used the same way and you can fill out as many or as few as the data require. All the data you enter will appear on the report, exactly as it is (mis)typed. Try to be succinct. When you come to the *Moving Between Tables* screen (see example on next page), there will be no *X* showing but all is well.

8.5 Add References

Click *References*. The *Cross References* screen appears. This builds the attachments between the references and the Dataset ID using a file called DSIDXREF. The current piece of this file is in the grey area. The top part of the screen allows you to explore the references file and get ready to add new cross references when you have the right stuff selected.There are two ways to find the reference you need. One uses the *CODIS Citation* button. Click it to open the box to the right. Then type the first few characters of the first part of the citation. This might be sluggish as the references file is huge, but will put the pointer at about the right place in the file. Scroll up and down to find what you want. If you have trouble with the pick-list, use *Esc* to back up or click on *OK* to return to the *Moving Between Tables* screen. The most common problem is that the mouse strays from the pick-list box while you are trying to find something.



Screen showing options for moving between reference and rating tables

If you get an error that makes you look at the code, do *File, Close* and answer *OK* to the question "Halt running code so window can close?" There will be no harm done. The other way to find a reference is to click the *CODIS Ref-Code* button and use the rectangle to type in the code. This is faster because it is indexed, but you need to know the codes. You probably have this resolved already, as you would have updated the CODIS references with your new references before you got started here. See the *Manage CODIS* section.

When you have the right reference, or the right ref_code showing, choose a discipline for this reference using the *Discipline* list in the rectangle. You also need to indicate if this is a primary or secondary reference. Click the dot to the left of *Primary* or *Secondary* to set this flag. When it all looks right, click *Add Record*. *OK* gets you to the *Moving Between Tables* screen, but it does not update the database. If there is a problem, you can delete the reference by clicking on the offending section in the grey box, followed by *Delete Current*. Reassure MSAccess that you know what you want and the deed is done. If you have trouble with the pick-list, use *Esc* to back up or click on *OK* to return to the *Moving Between Tables* screen.

8.6 Add *Regions* and *Areas*

It is a good idea to do Region before Area so that the Region can be used to shorten the list of area names presented. But it's not essential. Click *Regions* to open the *Regions Cross Reference* screen. This is the simplest way to look at the database. There is a triangle or pencil in the grey band to the left of the screen which shows the current record (if any). A star shows the last record available for input. On the starred record, click the *Region* name box and make a selection from the list. Once a selection is made, a new starred record opens below. Do as many as are appropriate for the Dataset ID you are working on. If you make a mistake, use the *Delete Current* button to delete the record that has the triangle adjacent to it. When it is all complete, *OK* will exit.

Click *Areas* to open the *Areas Cross Reference* form. This one works like the previous References Cross Reference form; the upper part allows you to find the area name you need, the lower grey and white area shows the areas assigned to the Dataset ID. Click on the *Region* box and select a region to restrict the areas presented. If you assigned a region(s) prior to this step, the choices here are only the one(s) you assigned. A click on the *Area* rectangle and a few letters typed in will get the section of the list you want. Alternatively, the *Area code* can also be used. Once you have what you need, use the *Add Record* button to make the assignments.

If you have trouble with the pick-list, use *Esc* to back up. The most common problem is that the mouse strays from the pick-list box while you are trying to find something and some nonsense is written into the *Area* or *Area code* box. You may have to delete the text in the *Area code* box, or the name in the *Area* box in order to get CODIS and MSAccess on the same wavelength. If you get an error that makes you

look at the code do *File, Close* and answer *OK* to the question "Halt running code so window can close?" There will be no harm done.

8.7 Add Concurrent Disciplines

This section is here because it is convenient to discuss it with the *References, Regions* and *Areas* buttons. But it is not necessary to use this button unless there is concurrent information to add in addition to the single discipline data you will usually add next. Click on *Concurrent Disciplines*. The screen is like the *References* and *Areas* in function, with an upper section to get the data organised, and a lower section showing the linkages already made. The lower section will only show if some attachments are already made. The column on the right is both a selector and an indicator of what is done at any point. The buttons that look depressed indicate the disciplines where concurrent information is known to CODIS. The dots control which discipline you will work with.

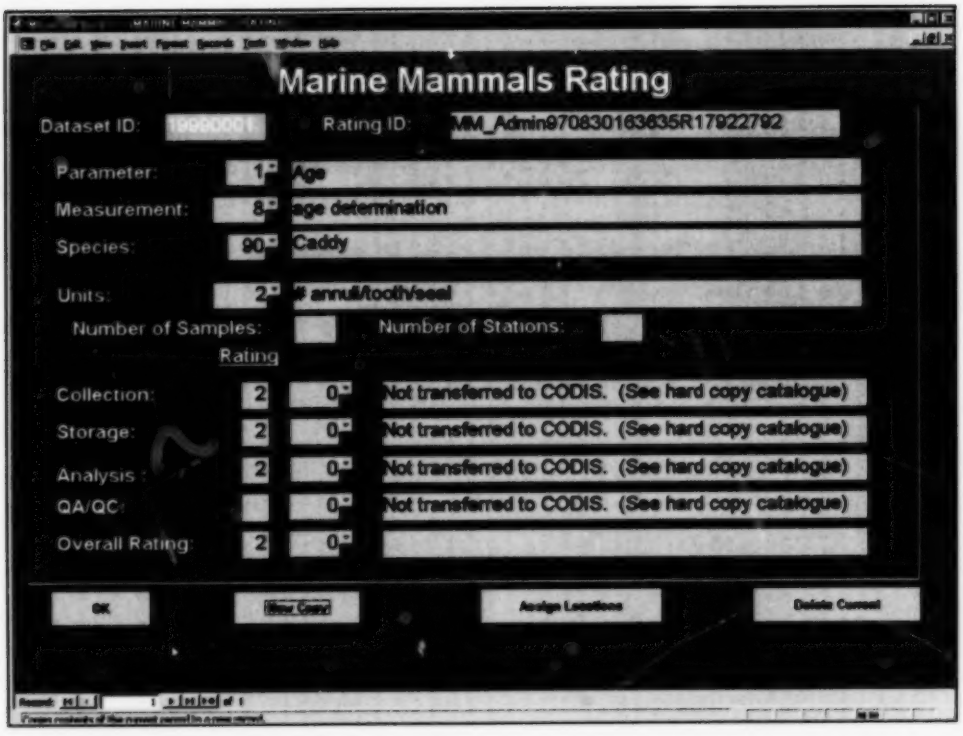
Select a discipline, e.g., MF by clicking on the dot to the right of the *MF* button. Marine Fish will appear in the *Editing Concurrent Discipline* box. Click the *MF_PARAM* box to open the parameter list for the discipline. Select one. The *MF_MEAS* box will appear, fill it in the same way if you wish. Level 1 requires only Parameter in most disciplines. The exception is Chemistry where a *GROUP* box will open to provide an intermediate level of detail. Once the top part of the screen is correct, click *Add Record*. Repeat as necessary. When done, *OK* will get you out. *Delete Current* allows you to make repairs.

8.8 Add Marine Mammals

Return to the *Modify Dataset - Moving Between Tables* screen, click the *Marine Mammals* button. The Marine Mammals rating form opens to show what is already assigned to the Dataset ID (if any). The scroll bar at the bottom left allows you to navigate. See a sample for the 19990001 example on the next page. For Level 1, you need only fill out Parameter, Measurement and Species. Each one works the same way. You can type a code in the left box, or you can click on the right box and scroll to the correct item. If you do Parameter before Measurement, then the measurement list is shorter.

Once it looks right, its done. If its wrong, the edits can be done as the inputs were. If its really wrong, the *Delete Current* blows the whole record away at once. The additional spaces on the form are the Level 2 details and work exactly the same way.

If there are multiple measurements or species, you will have to do them one at a time. The *New Copy* writes a duplicate of whatever is showing into the file and you can edit the screen image as if it were a new record. For ten measurement/species combinations you can do the *New Copy* nine times, and follow the tenth item with *OK* to complete the job. *OK* will exit to the *Moving Between Tables* form. For a new Dataset ID, there will be no *X* next to *Marine Mammals*.



Screen showing entry form for inputting marine mammals information

Click on the binoculars to run the procedure to check that the data is in order. You will have to answer *OK* to a question or two. There should now be an *X* next to the *Marine Mammals*.

9 Modifying existing datasets

This section continues the form-by-form survey of CODIS.

This part of CODIS is for dataset entry and maintenance. The forms here allow a user to edit every field in every table for a dataset, including the span across disciplines, regions, areas, stations, etc. The focus is on a particular dataset and its details.

Selection of the dataset to edit is the first step. From the *Main Menu* screen, pressing the *Add/Modify Datasets* button provides a selection form that will focus attention on a few datasets based on start date and end date. The selection looks for start dates in the dataset list that are in the range of the start and end dates on the form. Press the *Find Possible Match* button to continue.

The list of datasets matching the time range appears in a form called *Dataset Selection*. One of these Dataset IDs can be selected, or a new dataset can be generated using the *Create New Dataset ID* button. This new dataset will have the next available entry in the sequence of datasets for the specified year. For example, the dataset 19740055 might be in existence. A new dataset entry might be in the following year and could be 19750023 (if there were only 22 entries for 1975). This outlines the idea of sequence of dataset IDs. CODIS is not particularly concerned about the order of entry of datasets in the database.

Having selected a dataset by clicking on *Go To Dataset ID* or if you created a new one, the notes related to the dataset are displayed. These are the "Global Metadata" which apply to the dataset as a whole, i.e., across as many disciplines as the dataset might involve. There are spaces for brief notes on project description sponsoring agency, sampling or research platform, and cataloguer's comments. All of these allow text string entry, but it is a good idea to have some protocol in mind. See the most recent CODIS datasets on Marine Mammals in the Georgia Strait region or the Continental Benthos in the Fraser River Estuary for the level of protocol, which can be expected.

The *Selection Review* button will back pedal to the choice of Dataset ID list. At this *Dataset Selection* screen, more back-pedaling is reached via the *New Selection* button, the date range can be revisited and a new list of datasets for perusal generated. There is also a grayed-out button for deletion of a Dataset ID. There is function behind this button.

If a Dataset ID is a complete mistake, perhaps, there is a need to delete it. This dataset deletion really is a management function, however, and we have hesitated to delete valuable datasets by mistake. (There could be a lot of power behind this deletion!) An alternative method is to ensure that the black triangle is at the appropriate dataset row and press *Delete* on your keyboard. Datasets span many tables and the details of cleaning up "lint" also require some attention. We have held off on the "black box" treatment to fixes. But you can explore it on your copy.

9.1 Add more details

More dataset details can be viewed following a press of the *More* button. This displays a form that outlines the different metadata tables with which the particular dataset is associated. On the *Moving Between Tables* form, there is a camera button. This button controls the little check boxes adjacent to each of the disciplines. It starts a search through the discipline tables to see where this dataset has data [Note: this may take a little time]. The Dataset ID table is a master table and includes a result of this search indicating which disciplines are cited in the dataset.

The Dataset ID table is updated for the current dataset following the action on the camera button. One might say that the overview of the dataset is captured ("imaged") in the Dataset ID table. An appraiser or data entrant would use this button

when adding a discipline to a dataset. The check boxes beside the discipline names reflect the overview in the Dataset ID table. In other words, these check boxes give a first peek at discipline(s) in the dataset.

9.2 Enter Concurrent Disciplines

The Concurrent Discipline Cross Reference form appears if the *Concurrent Disciplines* button is pressed from the dataset detail screen. This one is a conceptual feature and the disciplines are listed on the right of the form in short hand. If this form has been previously visited (and used) for this dataset, some of these discipline buttons will be coloured. If the mouse is moved to the target near a discipline and then clicked, the information for concurrence regarding parameter and measurement is activated.

There may be several records of concurrence for that discipline, each entry reviewed in turn by selection in the bottom left hand corner subform on the *Concurrent Discipline* form. New data is only added if a parameter (and possibly a measurement) is selected for the current concurrent discipline and the *Add Record* button is pressed. The *OK* button merely returns to the *Moving Between Tables* form, without the change. These concurrent entries can be deleted one by one from the selected concurrent discipline.

9.3 Enter References

There are some 4800 references in CODIS. This dataset references form allows selection from the list. There are two choices for searching the references list. Either one will allow the user to find the reference required to associate with the active Dataset ID. The current list of references associated is given in the CODIS Citation box.

9.4 Enter *Regions*

The eight regions are listed for selection under *Region Name*. The current set of regions associated with the Dataset ID is given in the list box. *OK* leaves the form with the list as shown. *Delete Current* removes the highlighted region. Once regions are selected, the Areas option is available.

9.5 Enter *Areas*

Areas can be selected for regions as activated under regions. This grouping reduces the search through places outside the associated region(s). The current set of areas associated with the Dataset ID is given in the *Area* list box. *OK* leaves the form with the list as shown. *Delete Current* removes the highlighted area.

9.6 Enter *Locations*

The *Locations* button directs the user to a choice of discipline, and type of geographical location information (Station, Transect or Polygon). There are a number of ways this can work. The form just needs to be completely filled out with latitude and longitude and the other information required by QUIKMap. You can type this in once you have opened the *QUIKMap Details* form. Alternatively, you could have already established a list of named stations (e.g., transects or polygons) within the appropriate discipline specific location tables using a process outside CODIS. In this case, all that is required is to associate this preexisting data with the Dataset ID by entering, for example, the station name or the XX_STN_CD (Cross Station Code) in the appropriate section of the form.

Another alternative is to activate QUIKMap from this form, locate the station (e.g., transect or polygon) on the QUIKMap screen, enter and tag the location with a station name, and then on leaving QUIKMap, associate this new station with the name you just created. Upon exiting QUIKMap, you will be warned that the "station files" will be updated with new information. Many locations will be associated with a single Dataset ID, so the associated information can be paged forward/backwards using the lower left control buttons.

9.7 Enter *Ratings*

The *Go to Ratings Tables* area of the *Moving Between Tables* form presents the eight disciplines on unique buttons. Only four of these are active as the data entry at Level 2 for the other four disciplines has not been developed yet. Each discipline has unique discipline specific tables to work with, but all four active disciplines work the same way. At each point on the specific Ratings form, a pick-list of choices can be activated with a mouse click. Alternatively, if the data entry person knows the codes, these can be typed in directly. The selection of *Parameter* will restrict the choices available under the *Measurement* or *Constituent* pick-lists. Numerical data (ratings, detection limits, etc.) are directly typed on the form.

Some disciplines, like Continental Benthos, have rich taxa tables. This richness is too great to be represented by a pick-list and an *Assign Taxa* function is provided. This works just like the *References*, *Regions* or *Areas* buttons on the main form, and allows many species to be associated with a single measurement. In disciplines like Marine Mammals, where the number of species is small, each measurement/species combination must be created separately.

The ratings forms offer three choices: *OK* to leave the form with the data as shown, *Assign Locations* which opens the *Assign Locations to Rating* form, and *Delete Current* which deletes the current record. Marine Mammals also has another button entitled *New Copy* which copies the contents of the current record to a new record. You will need to do a click on the camera to update the complete Dataset ID record when adding a new discipline to a Dataset ID.

Managing data protocols, identification numbers and relationships

Pressing the *Manage CODIS* button transfers attention to the *Maintain Protocol* screen. The options on the *Maintain Protocol* form are:

- Disciplines
- References
- Regions
- Areas
- Discipline Protocols
- Manage Dataset IDs
- Import Data
- Export Data
- Rebuild Regional Relationships

10.1 Revise *Disciplines*

There are currently eight disciplines. One might begin here if they were adding another discipline to CODIS. We view this as a very ambitious step since many forms, tables, queries and reports follow from this initial decision of database structure.

10.2 Revise References

All references in CODIS are in one table. This table currently has some 4800 entries. The references are assumed to be used by several datasets. The references have structure (authors, dates, titles, etc). They are formatted and are intended to be publication ready. References exceed the maximum length of a string (255 characters) and so they are memos. This technical detail requires the use of a short "searchable" string since memos cannot be searched or sorted by MSAccess.

10.3 Revise *Regions*

There are currently sixteen regions identified in CODIS. These each has a map displaying the intended boundaries. Once the Regions are defined, the Areas are layered on this base. Adding a new region will have relatively minor consequences for searches and so on.

10.4 Revise *Areas*

Areas are viewed as parts or subsets of regions even though some areas occur in several regions. Moreover the same name of an area can be applied to different features in different regions. For example, "How many Duck Lakes are there in Canada?". CODIS tries to respect the fact that there are oodles of areas and they need to be loosely defined. Nonetheless, to add a new area you need to give it a

name, specify what region it associated with, and a specific latitude and longitude where the area can be located as a dot on a map. If your new area lies on a border of two regions you can associate it with both regions if you wish.

10.5 Revise *Discipline* - specific protocols

Press the *Discipline Protocols* button to view the discipline selection screen, which will guide you to a form on which all the tables associated with a particular discipline are listed. This section of CODIS allows you to look at the scope of the metadata categories, and add new categories for new data input. The disciplines and the associated two letter codes are:

- Continental Chemistry CC
- Continental Benthos CB
- Ocean Physics OP
- Ocean Chemistry OC
- Marine Plankton MP
- Marine Benthos MB
- Marine Fish MF
- Marine Mammals MM

There is a protocol form for each discipline. Under Marine Mammals, for example, the protocol form shows these buttons:

- Sample/Collection Notes
- Storage Notes
- Analysis Notes
- Quality Assurance/Control Notes
- Rating Notes
- Interval Notes
- Parameter
- Measurements
- Measurement Methods (placeholder, not used)
- Measurement Units
- Taxonomic Classification
- Survey Notes
- Location Notes

Most of the choices occur in most of the disciplines. Those that act only as placeholders in this version of CODIS, are depicted in gray lettering. The goal has been to provide a flavour of common structure across the disciplines and to force structure on the searchable values. We have worked really hard to get these protocols under control, so that there will be "a place for everything, and everything in its' place". Before you add anything, and especially before you consider using the "other" or "miscellaneous" categories, you need to ask yourself, "Is this REALLY different from the choices CODIS gives me?". If the answer is other than a

resounding and heart-felt "YES", we suggest that you act cautiously and possibly think it over carefully once again.

An important Note -- You can add, modify or delete entries in any discipline, any table or any protocol using this module of CODIS. You see and manipulate the live data. Therefore, any changes will be kept in CODIS tables. This means your copy will be different from the one you started with. We are not suggesting that you would deliberately corrupt your data, but you have been warned. See our suggestions for how to keep clean data and backup files in the *Installing CODIS* section.

10.6 Manage Dataset IDs

Where do Dataset IDs come from? New ones are created in CODIS at data entry time using the start year and a computer selected sequence number in the structure of the Dataset ID string. Alternatively, the Dataset ID may have been imported from human generated catalogues.

What if these Dataset IDs are to be reorganised, or if Dataset IDs are created off line, or if Dataset IDs are committed more than once. How are errors or deletions managed? Management of this Dataset ID string is the goal under this button. The Dataset IDs are the key in many tables. One Dataset ID can span several disciplines. So changing one is complex. Review the Table relationships in MSAccess (*Edit* or *Tools*, *Relationships*) to see just how complex. To make this even more exciting, there are historical variants on the Dataset ID shape, for example, there are subgroupings of Dataset IDs that have incorporated a terminating letter ... 19530019A. How do we handle these details?

This section provides code that tests these ideas, but it is not recommended on the critical copy of CODIS. Expansive changes to the data are possible here and care is required. The current version has this button disabled, but is present to demonstrate the interest in the issue. How would you know if the update was effective, complete, clean? Are the current Dataset IDs unique? ... NO. Could the Unique_IDs do the job? At this time, we don't really know.

10.7 Import and export metadata

There are huge collections of meta-data "out there". If one wishes to explore some of this in CODIS, what are the options? If (and a big if) data has the right shape, we might wish to import a whole discipline, or blocks of data. The discipline would have to include several tables in a format which would import into MSAccess (Dbase III was the original assumption). Similarly, we might imagine exporting a discipline for similar translocation to some other use. Some assumptions are required in automation of such a task. For import, a set of tables that are required must be established. Somehow the Dataset ID table must be updated, in other words, the discipline must be fitted to the existing structure. How much automated massage of the database is OK?

Experience in-house has been that we need human intervention to do the import and export routines. We need awareness of fields, record counts and sizes, and testing requirements. But there are routines in CODIS that explore the requirements of automatic import and export. These have been disabled in the current version but you are free to work with them under this button.

10.8 Rebuild Regional Relationships

The assumption in Rebuilding Regional Relationships is that datasets have latitude and longitude information. Given this, in which region and area is the dataset located? The original plan was that the mapping software would allow drawings of regions and the stations, then run a comparison for inclusion of data in tables in CODIS.

There are several problems here. The regions themselves have polygon structure and these have not been naturalized in CODIS MSAccess. This is a shortcoming of MSAccess' ability to handle binary files. Polygons for mapping are exported in compressed code to DBaseIV files that are then unzipped each time they are needed. Thus polygons, and the regions polygons reside on the QUIKMap stage. Secondly, the search of points in polygons is a little mysterious in the QUIKMap world exactly how does this work? This is proprietary to QUIKMap and we have a black-box relationship with it. Finally, does one really want to overwrite huge fractions of the database with new calculations that are "on the fly"? Since this function *apparently* works correctly, we have chosen not to polish it.

11 Making your own custom queries

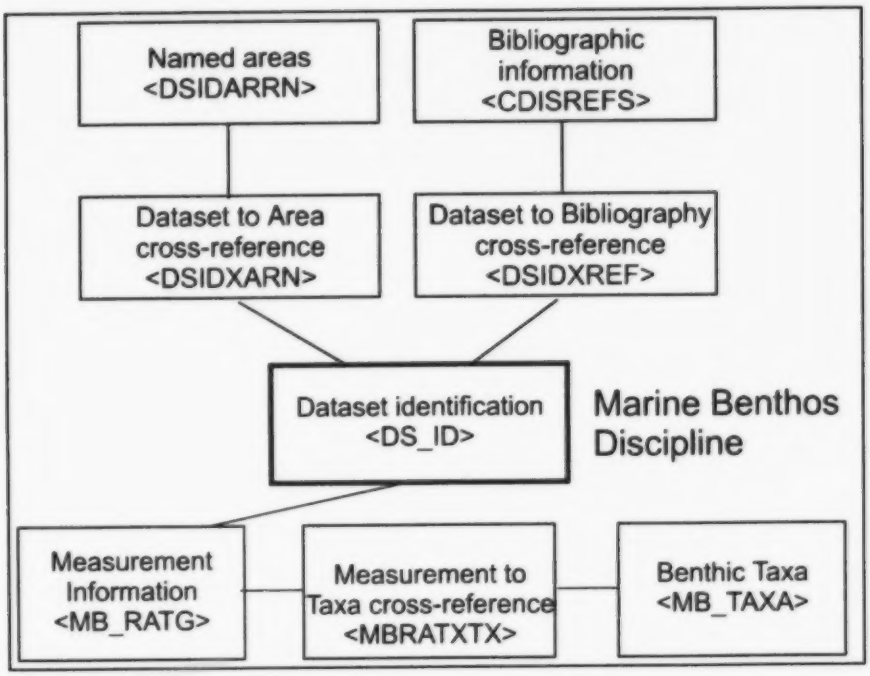
There is a lot more to CODIS than meets the eye. The purpose of this section is to show a bit of what is behind the scenes, to walk through a custom query of the data, and to produce a custom report.

1. First get a look at the database. On the MSAccess menubar, click *Window*, *Unhide* and *OK*. The view passes to MSAccess and a list of Tables, Queries, Forms, etc. You can navigate using the tabs on the screen, or using the *View* (*Database Objects*) on the menubar. Find the Tables and highlight one of them. For example, choose the DS_ID table. Double click on DS_ID or click on *Open* to see what is inside this table. You can navigate with the scroll arrows, and can use the *Edit, Find* feature to explore the table. Some of the columns are obvious but others are cryptic. *View, Table Design* will give you a view of how this Table is organised and what each field is for. All CODIS data Tables have some commentary like this to help you figure out how we have used the fields. Click *File, Close* to exit.

2. The Tables are related to one another by creating relationships between the same field in different Tables. You can peek at this using the *Edit* or *Tools*,

Relationships function on the MSAccess menubar. The scroll arrows move you around. You will see a tangle of relationships between the database Tables. This is the strength of CODIS, and its Achilles heal. Do *File, Close* to exit. Reflect on whether you want to work with this tangled web.

3. The relationships between the Tables are better presented in the Data Dictionary section of *Learn About CODIS*. The example we will work here is going to make a report of the marine benthic species that have been reported in the Tuktoyaktuk Shelf area of the Beaufort Sea. We will want a dataset ID, a citation, and a list of species associated with each Dataset ID. So we need to know how the data is organised in this section of CODIS. The figure below is a subset of the Marine Benthos one in the data dictionary that shows the relationships we need to explore.

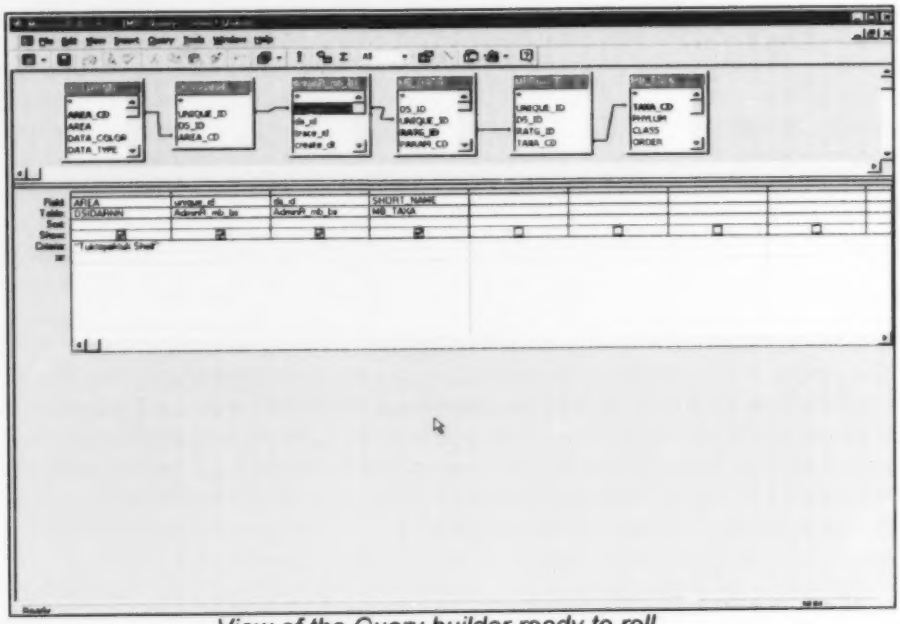


Abbreviated view of the relationships between Marine Benthos Tables

4. The Tables we need are also indicated in the figure on the next page. The named area "Tuktoyaktuk Shelf" is in the DSIDARRN Table, the bibliographic citation is in the CDISREFS Table, and the Species are in the MB_TAXA Table. The diagram assures us that these are linked somehow. So we can start.

5. It is a good idea to use CODIS to get close to what you want. Under *Window*, go back to the CODIS *Main Menu* form, and do a Level 1 search for the Marine Benthos discipline and the Canadian Beaufort Sea region. Use a *Save Search Result* name of "mb_bs". Click on *Search* and you get 73 datasets. Click *OK*, then use *Preview* and you will see that some of them are in the right area. Use *Window* to return to the CODISII database, and get to the Table. You will be able to find a table called "AdminRmb_bs" which you can look at. This is the result table generated by the search you just did. There is also a Table "AdminH_mb_bs". This header information is used on the reports, and consequently, we will not need it.

6. Shift to the Queries view of the database and click *New*. Depending upon the version of MSAccess, next click on either *New Query* or *OK*. Similarly, either an *Add* or *Show Table* box appears with a scroll bar and asks you to select Tables to work from. Scroll down to "AdminR_mb_bs" and double click on it. Scroll further down and double click on DSIDARNN, DSIDXARN, and further down to MB_RATG, MBRATXTX and MB_TAXA. The reasons for these choices are shown in the relationship table presented above. Click *Close* to see a workspace with the Tables you selected. Some of them are linked, but AdminR_mb_bs is not tied to anything. You need to link them up as the previous Figure implied. You can see each of the Tables has a field "unique_id". Click on the one in AdminR_mb_bs and drag it to the DSIDXARN Table. A link will be created. Do the same to make a link with the MB_RATG Table. Things are probably pretty tangled, so slide the Tables around to get the picture as clear as you can. The screen below shows the layout we used.



View of the Query builder ready to roll.

7. You can then build the query by double clicking on the field in the Table. The field hops down to the first column on the table beneath the view of the linked tables. Do this for AREA in DSIDARNN, unique_id and ds_id in AdminR_mb_bs, and SHORT_NAME in MB_TAXA. You then need to establish a selection criterion. Under the AREA column in the Criteria row type "Tuktoyaktuk Shelf". You do not need the quotes, as MSAccess will supply them.

8. So Run the query! Use the "!" in the toolbar, click the *Datasheet View* or *Query View* symbol on the left side of the toolbar or do *Query, Run*. Your hard drive grinds for a while and a datasheet appears with four columns as you had in your query. This datasheet has 11690 rows. Look closer, you will see some apparent duplicates! What is going on? These duplicates are due to the way you structured the query. You asked to find all different occurrences in the cut across the database. Along the connecting links there are different fields, for example, Measure_CD in MB_RATG. The two ends might be the same, but there might be several rows with different stuff in between. To solve this you need to more precise in your question. On the MSAccess toolbar click on either *SQL View* or *View, SQL*. You are treated to something that should look like:

```
SELECT DISTINCTROW DSIDARNN.AREA, AdminR_mb_bs.unique_id, AdminR_mb_bs.ds_id,
MB_TAXA.SHORT_NAME
FROM ((DSIDXARN INNER JOIN DSIDARNN ON DSIDXARN.AREA_CD = DSIDARNN.AREA_CD)
INNER JOIN AdminR_mb_bs ON DSIDXARN.UNIQUE_ID = AdminR_mb_bs.unique_id) INNER JOIN
((MBRATXTX INNER JOIN MB_RATG ON MBRATXTX.RATG_ID = MB_RATG.RATG_ID) INNER
JOIN MB_TAXA ON MBRATXTX.TAXA_CD = MB_TAXA.TAXA_CD) ON AdminR_mb_bs.unique_id =
MB_RATG.UNIQUE_ID
WHERE ((DSIDARNN.AREA="Tuktoyaktuk Shelf"));
```

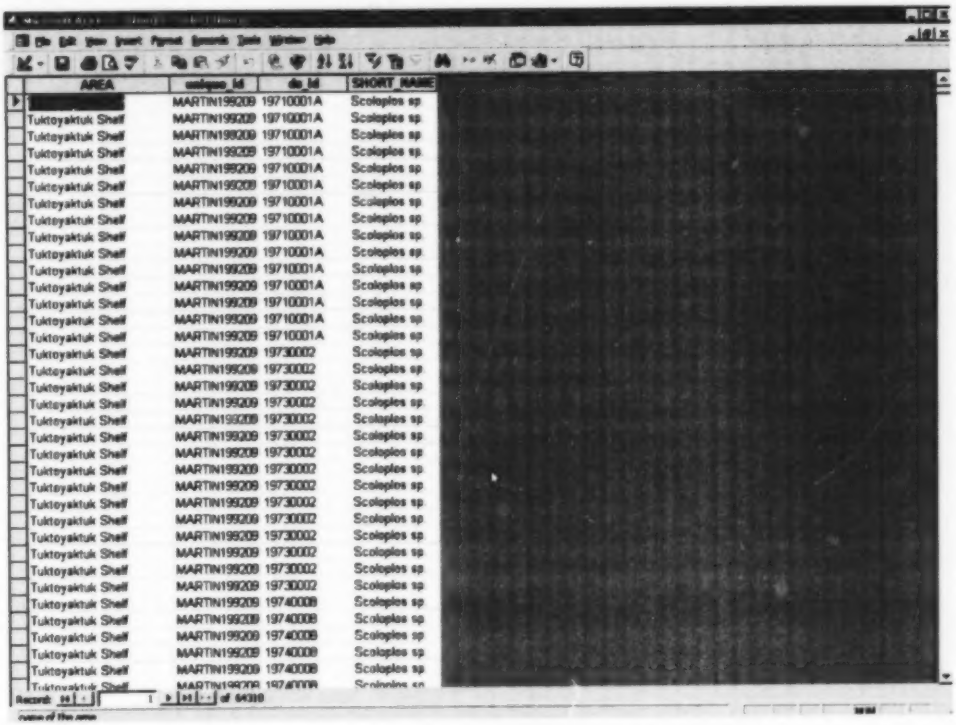
The SQL has some readability to it, and fortunately, the part we need is right at the start. You asked for "DISTINCTROW". What you really want is the truly "DISTINCT" result, so use the mouse and the delete key to remove "ROW". This gives you:

```
SELECT DISTINCT DSIDARNN.AREA, AdminR_mb_bs.unique_id, AdminR_mb_bs.ds_id,
MB_TAXA.SHORT_NAME
FROM ((DSIDXARN INNER JOIN DSIDARNN ON DSIDXARN.AREA_CD = DSIDARNN.AREA_CD)
INNER JOIN AdminR_mb_bs ON DSIDXARN.UNIQUE_ID = AdminR_mb_bs.unique_id) INNER JOIN
((MBRATXTX INNER JOIN MB_RATG ON MBRATXTX.RATG_ID = MB_RATG.RATG_ID) INNER
JOIN MB_TAXA ON MBRATXTX.TAXA_CD = MB_TAXA.TAXA_CD) ON AdminR_mb_bs.unique_id =
MB_RATG.UNIQUE_ID
WHERE ((DSIDARNN.AREA="Tuktoyaktuk Shelf"));
```

Run the revised SQL and you will get a datasheet with 2338 rows that resembles the screen capture, as illustrated on the next page.

9. OK so far? Now we need to add the bibliographic citation. Go back to the design view (*View, Query Design*) and do either *Query, Add Table* or *Query, Show Table*. The box opens up with the list of Tables. Click to add CDISREFS and DSIDXREF to the query. *Close*, reorganize your view, and make the links between

AdminRmb_bs and DSIDXREF using unique_id (i.e., drag "unique_id" from one table to the other). Add "Citation" from "CDISREFS" to the query (double click). And do *Run*. When the datasheet appears it has exploded to 13163 rows, which is all the combinations of reference with species. If for whatever reason your query "crashes", it may be time to COMPACT the database and retry the query.



AREA	unique_id	ds_id	SHORT_NAME
[redacted]	MARTIN199209	19710001A	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19710001A	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19710001A	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19710001A	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19710001A	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19710001A	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19710001A	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19710001A	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19710001A	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19710001A	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19710001A	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19710001A	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19730002	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19730002	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19730002	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19730002	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19730002	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19730002	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19730002	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19730002	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19730002	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19730002	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19730002	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19730002	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19730002	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19730002	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19740008	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19740008	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19740008	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19740008	Scoloplos sp
Tuktoyaktuk Shelf	MARTIN199209	19740008	Scoloplos sp

Screen showing datasheet results after SQL query

It's time to back up a bit and think how to avoid this combinatorial problem. We were able to make a simple cut of the data in the first query we did. We presumably could do the same with other pairs, like "Tuktoyaktuk Shelf" and "Citation". These results would then be independent of one another, so we could then link the pieces without the combinatorial problem. THIS IS GOING TO BE REQUIRED FOR EVERY INTERESTING PROBLEM YOU WANT TO EXPLORE IN CODIS. So be sure you understand why we are doing the next couple of sets.

10. It is easiest to make two separate Tables and pull the two together at the report time. They need to be related somehow, so let us choose ds_id as a common element to both Tables. Let's fix up the "species" query first, save it as a Table, then do the same with the references. So click on the Tables you do not need (DSIDXREF and CDISREFS) and the delete them with the *Delete* key. We don't really need the unique_id, so go to the bottom table and click at the head of the

column and similarly delete it. We also do not really need to see "Tuktoyaktuk Shelf" 2338 times, so click on the *Show* box in the *AREA* column. Select *Query, Make Table* or *Make-Table Query* from the toolbar and in the box give the resultant Table the name "an_mb_taxalist". (It is a good idea to start the Table with an "a" so it will stick to the top of the list somewhere.) Click *OK* and *Run*. You can look at the result Table (*Window, CODIS2: database, Tables*) to see if it worked correctly.

11. We were pretty sure that would work because we had done the *Select Query* in the earlier stages. We need to explore the bibliographic problem a bit, and we do not want to accidentally overwrite "an_mb_taxalist" so *Query, Select* or *Select Query* from the toolbar is the right thing at this point. Remove the Tables we do not need (MB_RATG, MBRATXTX, MB_TAXA), add the ones you do need (DSIDXREF CDISREFS), link DSIDXREF to AdminR_mb_bs on unique_id, add the CITATION field from CDISREFS, and add the DISCIPLINE field from DSIDXREF. Set the criteria for DISCIPLINE to "MB". This is a trick we have hardwired into DSIDXREF to avoid another type of combinatorial problem with references that are linked to more than one discipline. Your final Table only needs ds_id and CITATION, so you could click the *Show* box under DISCIPLINE.

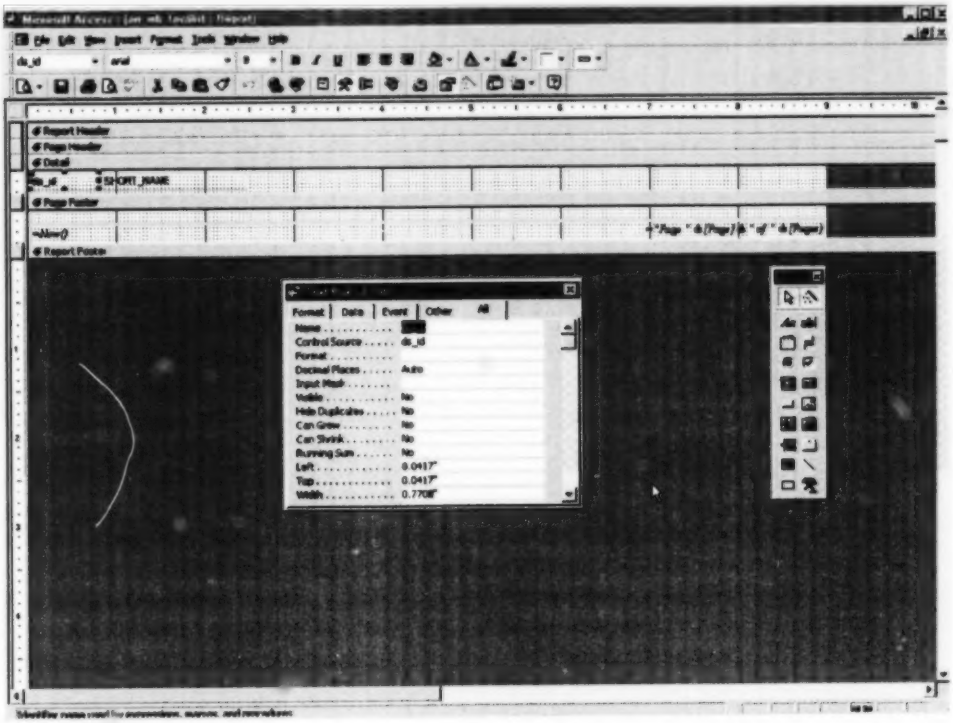
12. If you do *Run* now you will get the "DISTINCT" error, so click *View, SQL* or *SQL* on the toolbar and add the "ROW" after "DISTINCT". Now *Run* and the query will execute to give a 61 row result datasheet. This might have some duplicates, but there is no easy way to prune this further. Go back to the design view (*View, Query Design*), select *Query, Make Table* (note - both these steps can be short cut using the toolbar), give it a name of "an_mb_reflist". Finally click *OK* and *Run*. You can view the Table as noted in the previous step.

13. Next we will generate a Report, using the MSAccess Report Writer. Get to Reports and press *New* or *New Report* from the toolbar. We are going to first make a "subreport" to deal with the species for each dataset_id. Then we will make another report for the bibliographic information, and pull the species subreport into that second report. The choices offered in the box are cryptic. Type in the Table name "an_mb_taxalist" or pick from the drop-list and then click on either *Report Wizards, Tabular, OK* or *AutoReport:Tabular, OK*.

    In the case of using MSAccess 2.0 and the Tabular Report Wizard, it will prompt you to include whatever fields you want on the report, in this case select ds_id and short_name, then *Next* and finally sort by both and *Finish*. Stuff happens, and you are left with a view of a column of ds_ids and a column of species names. The subreport really does not need a lot of the material MSAccess created, so either click on *Close, Yes* to save the Report as named, or with an_mb_taxalist highlighted in the Reports list, click on *Design*.

14. Click to select the title and delete it. There are some lines to delete too. Once the header box is "clean", shrink the Report Header section to nothing by dragging the

bottom edge upward with the mouse. Do the same with the stuff in the Page Header section and drag it up, out of sight. It would be nice to see things only once, so click on the *SHORT_NAME* box, and then on the *View*, *Properties* or utilizing a right mouse button click to bring up a list, click on *Properties*. This will in effect open a dialogue box that tells the report writer how to work. Choose "Yes" for *Visible*, *Hide Duplicates*, *Can Grow* and *Can Shrink*. We probably do not need to see the ds_id in this part of the report (but we do need it), so click on the ds_id box, and set *Visible* to "No". The screen will look like the one below, and the Print Preview will give a very simple list of species with ds_id in sight. Next *File*, *Save* as "an_mb_taxalist_subreport", and *Exit*.

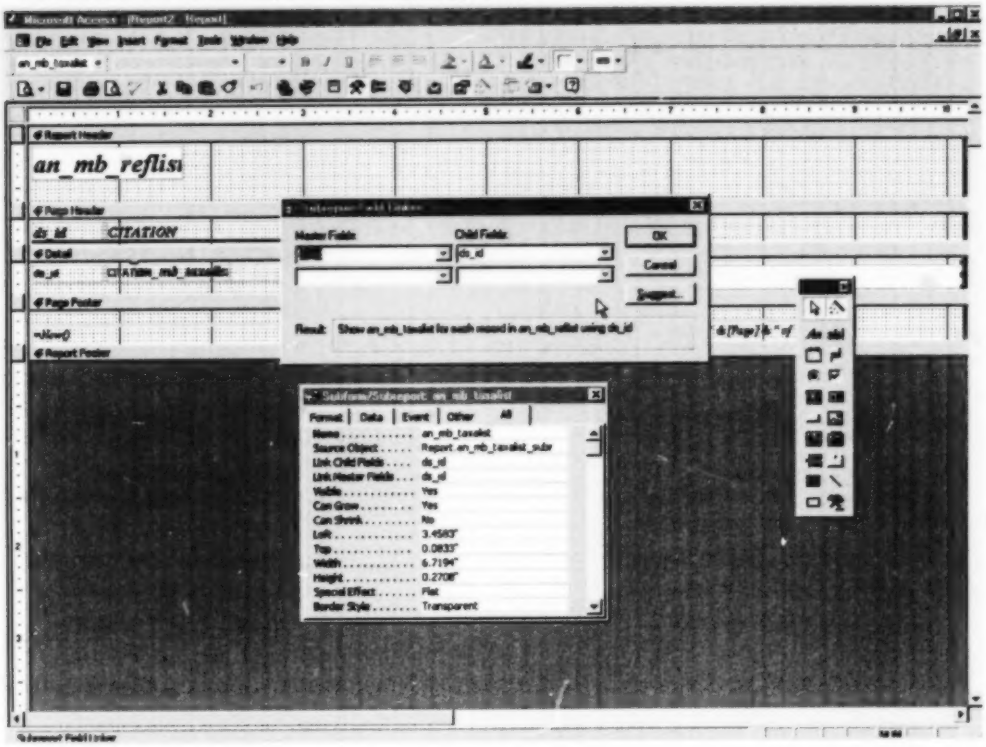


Screen showing dialogue box options for generating a custom report

15. Once again, click *New*, enter "an_mb_reflist" and either refer to item 13 for directions regarding MSAccess 2.0 or *AutoReport:Tabular* to get started with the main report. You save a lot of space by stretching the *Citation* box across the page, while at the same time setting the *Can Shrink* to "Yes" under *Properties*. We called ours "an_mb_report". When you have a report that looks okay and has a ds_id and citation showing, then you can add the subreport. Choose *Window*, *Tile Horizontally* or *Tile Vertically*. One half of your screen has the design view of the report, the other shows the Report section of the database. Click on "an_mb_taxalist_subreport" and drag it from the other window into the *Detail*

section of the form. You are finished with the Report windows so you can shift to full screen. MSAccess has created a title and a new object called "an_mb_taxalist_subreport". We removed the title and did some reformatting.

16. The last requirement is to link the subreport to the main report. Click on the *Subreport* box , then on the *Properties* box and click on the dots on the right end of the *Link Child Fields* box. This opens a *Subreport Field Linker* box that suggests you link on ds_id. For MSAccess 2.0, manually type in "ds_id" for both *Link Child Fields* and *Link Master Fields*. The view is like the figure below. Click *OK*, and hit the *Print Preview*. If all is well, you will get a report with ds_id, bibliographic citations, and a list of species. You can explore, print, whatever. We saved the main report as "an_mb_report".



Screen illustrating menus used to link a subreport with the main report

17. **Congratulations!! That is a tough slog for *anyone!!*** You will have noticed that we still did not get all the duplication out of the report. For example, each Dataset ID has a list of species below it. That's life! In this case, and in most cases, the amount of duplication of this type is tolerable for the amount of effort expended. The next step is to link the Citations into a single string (as CODIS does for its reports). That is a lot of work. Even though there have been lots of steps to this

point, it gets relatively easy with practice. You can use a wordprocessor to remove the duplicates. It is much faster than getting the Report Writer to behave.

12 Troubleshooting common problems

12.1 I can't get the database to run at all.

We assume that your copy of MSAccess works. You can check this by opening the NWind.mdb that Mr. Gates gave you with your copy. All the stuff should work. If not, then your problems is with MSAccess. If NWind.mdb runs smoothly, CODIS should too. You might try re-installing CODIS and if you can accept the default directory choice.

12.2 I can get the database to run, but I can't get the maps.

Do you have QUIKMap correctly installed? QUIKMap is installed as a stand alone program and you should be able to run it by itself. You can run QUIKMap by selecting it from your programs start list. There is advice in the QUIKMap manual. The usual problems stem from a directory structure different from the one QUIKMap expects. The first time you run CODIS it searches for and resets the path in the QUIKMap ini file so if you have done this and didn't receive any errors things should be running fine.

12.3 I can get a map but it's not the one I want.

For example, you expect an Arctic map and instead see a map of BC. In this case press *Alt F* or *File* and choose *Base Map* and you'll get base map choices. Choose N. America, then *<Enter>*. You will then be given a choice of *Add* or *Change*. Hit *Change*, then *Esc*. The North America base map will magically appear.

12.4 CODIS was working OK, then suddenly I started to get errors.

The most common problems with operation of CODIS stem from MSAccess itself. The database is large, and MSAccess makes expansive use of computational resources. Odd faults accumulate as the database gets filled with leftover indices from queries and reports. Using the "Manage Search Tables" function to delete old and unused queries is only part of the story. You occasionally need to "compact" the database as a whole to remake the active indices and abandon old and unused index entries. So if you are getting odd problems, back out to MSAccess and do "COMPACT. In cases of persistent faults that "just appeared" in a working copy, you could try the MSAccess *Repair Database* function. This is a bit more time consuming, but should restore your copy to good health. If all else fails, blow the current version away and get a fresh copy. You did have it backed-up somewhere didn't you?

12.5 I just got stuck with a message box asking me to "halt code".

You have somehow created an error condition. This might be a "bug", or it might just be a "feature" of the path you chose to get to the point in the database (you might have skipped a step and CODIS does not have a table to work from). The best thing to do is to click "OK", then close the database using the MSAccess menubar and start again. Halting the running code makes MSAccess loose its place in the program, and important stuff gets forgotten, like where the database is located.